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THE MANUFACTURER AND BUILDER.

Vol. XI.—No. 1. JANUARY, 1879. ELEVENTH YEAR.

Economy of Fuel.

The problem of using fuel economically has become in some parts of the world one of national importance, especially in countries in which coal mines do not exist, where most of the fuel used has to be imported; but even for England, once so rich in coal deposits, it has become a very serious question, considering the impending exhaustion of her coal mines. Among us it is not a question of national interest, as, fortunately, our coal deposits are so enormous that we have coal enough for all the world for thousands of years to come; but notwithstanding this, economy of fuel is important here also, as it is for the personal interest of the consumer not to use more fuel than is necessary; and in establishments where coal is used by hundreds of tons, a saving of 10 or 20 per cent amounts to a considerable item in the end, and may involve the success or failure of large establishments, especially in such where fuel constitutes a considerable part of the running expenses.

There is a peculiar kind of waste going on in all establishments where steam-boilers are supplied with cold water to replace what is carried off in the form of steam. It is easy to estimate the percentage of this loss, by considering that it takes 966 units of heat, which are absorbed as latent heat during the conversion of water into steam, while it takes 240 units of heat to raise the temperature of water of say from 60° to 300°, the average temperature of water in steam-boilers under a pressure of 60 pounds to the square inch. As 240 is the fourth part of 960, is will be seen that 20 per cent of the heat of the fuel absorbed by the boiler is used to heat the feed of fresh water to the proper degree so as to make it convertible into steam, while the remaining 80 per cent of this heat only is utilized for the actual formation of the steam. Now, if this feed-water, instead of being projected into the boiler while cold, could, before entering, be heated to the temperature of the boiler-water by means of some of the waste heat always escaping by many ways from engines, furnaces, or boilers, it would involve a direct saving of 20 per cent of the fuel.

It is quite natural that this subject should long ago have attracted the attention of engineers and inventors, and that various devices should have been employed to accomplish this. Among them are several in which the steam escaping from the engine is used for this purpose, a variety of which we have described in former numbers of this journal. These, however, are not applicable in cases where all, or at least a great portion of the steam is not used for driving an engine, but for heating and drying purposes, and either returns to the boiler at a low temperature, or does not return at all, in which case feed-pumps must continually supply cold water.

Messrs. Babcock & Wilcox, of 30 Cortlandt street, New York, have lately accomplished a very successful utilization of the heat passing up the chimney, for this very purpose. Instead of letting the very hot gases continually produced by the combustion of the coal in the furnaces under the boilers, ascend through the smoke-stack and lose all their heat in the air, they utilize part of this heat to raise the temperature of the feed-water to very nearly that of the boiler, and they have applied this at the sugar refinery of Messrs. Matthiessen & Wiechers, Jersey City, where we have inspected the arrangement with much interest, and give in the adjoined engravings representations of the same.

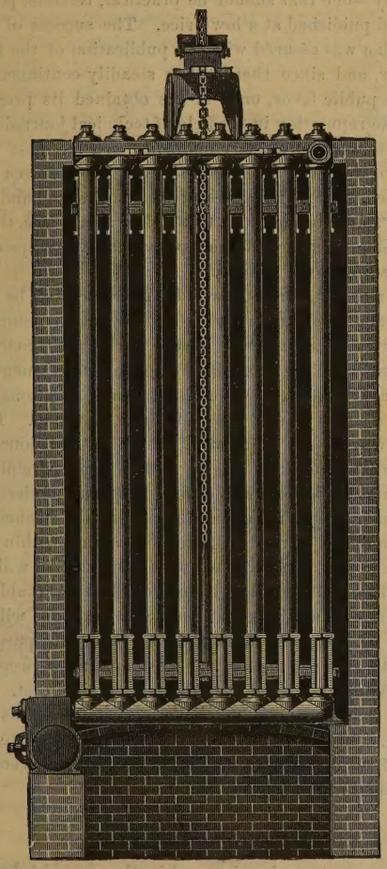

Fig. 1.

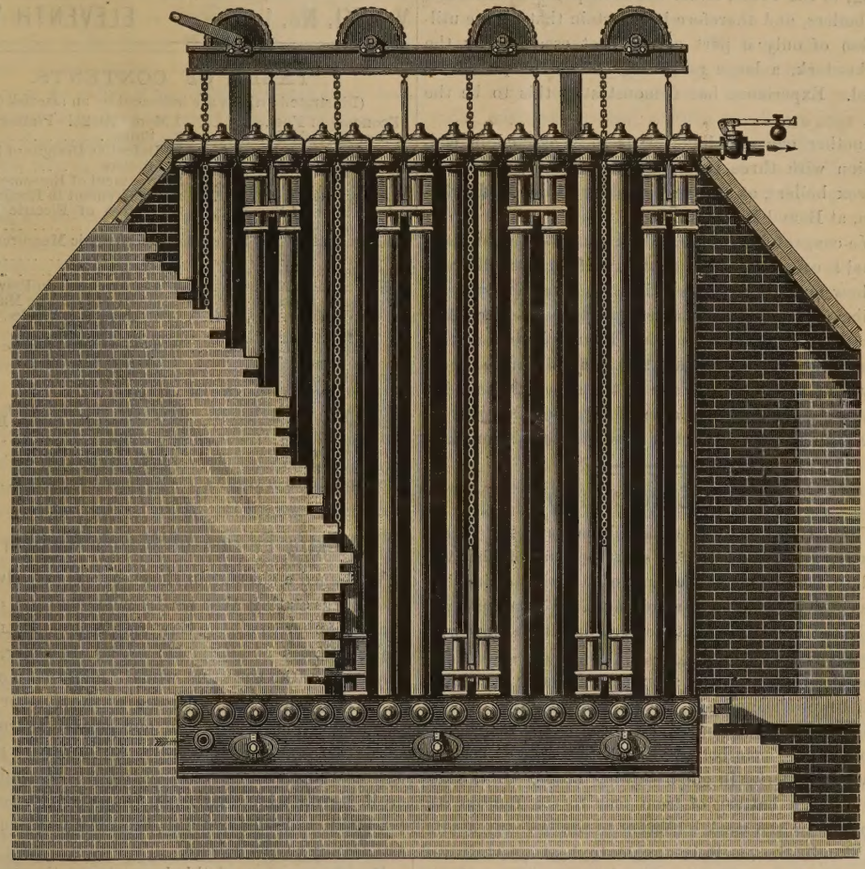

Fig. 2.

BABCOCK & WILCOX'S PATENT FUEL ECONOMIZERS.

A brick chamber was built on iron beams, placed at a hight of some 20 feet above the ground, and connecting the smoke-stack (150 feet high) with the boiler-house, standing some 25 feet apart. The hot gases from all the furnaces were made to pass through this chamber before ascending in the smoke-stack. Fig. 1 represents a cross-section of this chamber, while Fig. 2 is a longitudinal view, in which the greater part of the front wall is represented as having been removed in order to give a view of the interior arrangement. This consists of a series of vertical tubes, connected above and below with a system of horizontal tubes, and at the bottom with a mud-drum, seen in the cross-section at the left lower side of Fig. 1, while its front is seen in Fig. 2 below. The water supplied by the feed-pumps enters this system of tubes below, (see the arrow at the left side of Fig. 2), ascends in the tubes, and is thus

heated by the passing hot gases, and finds its exit to the boilers from the upper horizontal tubes, (see the arrow below the safety-valve at the upper right-hand corner of Fig. 2). As the chamber contains plenty of space around the tubes, they do not at all interfere with the draft, while provision is made to free the tubes daily of deposits of soot, which in the course of time will adhere to them. This provision consists of sliding scrapers, hanging on chains, passing over rollers on top, (see Fig. 2). Each chain supports two scrapers, which are suspended to both its ends, and balance one another. A workman goes daily to the top of the chamber and gives a few turns to a crank, which revolves each wheel, and this revolution while bringing one scraper down lifts the other up; in this way the interior is cleaned without interfering with the work or submitting any workman to the heat. For the soot falling to the bottom of the chamber, provision is made to give it room to accumulate until it is convenient to remove it, by holes in the bottom, from which it can be made to drop into wagons for removal.

The hot gases pass into this chamber (Fig. 2) from right to left, while the water passes from left to right, leaving the chamber nearest to the furnace, where it is hottest. By this arrangement it has been found that the water entering the boiler is already heated to 300°, being, in the tubes, under the same pressure as it is in the boilers, and therefore it is certain that by the utilization of only a part of the heat escaping by the smoke-stack, a large percentage of the fuel, must be saved. Experience has demonstrated this to be the fact.

Another one now building is to be erected in connection with three hundred horse-power Babcock & Wilcox boilers, at the new woollen mill of H. L. Einstein, at Bound Brook, N. J.

We congratulate Messrs. Babcock & Wilcox on their signal success, and hope that manufacturers will realize how much it is to their interest to adopt such or similar arrangements in case opportunities offer themselves for their construction. Even where the feed-water is heated by exhaust steam, a still further economy is attainable by the use of these heaters in addition, and particularly in case of large condensing engines, the economy from their use will be quite marked.

A New Electric Lamp.

Under this head we published, on page 231 of our October number for 1878, a short account of what was said to be a new electric lamp of Reynier, claimed to be as easily managed as an oil lamp. The account was published as we found it described, but we now wish to add our comments.

In the first place, as soon as a galvanic battery is used to produce a light it cannot be claimed to be as easily managed as an oil lamp, as every one knows who has ever been bothered with the duty of keeping galvanic batteries in good working order. In the second place, a battery of from four to six Bunsen elements gives too weak a current to produce any available illumination, as it is unable to heat a carbon rod to a white heat. Third, a wheel has to be revolved; this requires an apparatus. Fourth, a Bunsen battery cannot be stowed away anywhere, as it takes up a certain amount of space and gives off very noxious nitrous acid vapors, which must be conducted into the open air. Fifth, the claim that the heated portion of the carbon can be increased at pleasure, and by this a high degree of luminosity obtained, is nonsensical when so small a battery is used. Sixth, the use of a galvanic battery for producing strong electric currents is a backward step; it was the old method before magneto-electric machines, driven by steam-power, had been perfected. The latter are a great improvement on the batteries, as they are much less expensive, such batteries consuming 32 pounds of zinc for every 3 pounds of coal consumed in the furnace of the steam-boiler furnishing the power which generates the current. In fact, a return to the old troublesome galvanic batteries is by no means a novelty.

The Manufacturer and Builder.

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This journal has the largest circulation of any mechanical monthly published in the United States. Its value as an advertising medium is therefore apparent.

Vol. XI. No. 1. ELEVENTH YEAR.

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Extra Edition of March Number.

We issued a circular in December to our advertisers and others stating that we intended mailing our February number to all the SAW and PLANING MILLS in the United States and Canada; owing, however, to the shortness of the time that would be left us to complete our arrangements for the issue of the number, and at the suggestion of some of our largest patrons who think that a month later would be better for reaching spring trade, we have decided to defer the publication until March which will give us ample time to perfect our plans, and will, we think, besides give more general satisfaction to advertisers.

For the purpose of this issue eleven thousand extra copies will be required, which we shall publish and mail prepaid to those engaged in the above pursuits. This list we have prepared with great pains and corrected carefully up to date, rendering it of incalculable value to those wishing to reach these two great and growing industries. We think advertisers will not be slow to recognize the value of this extra edition, and we feel confident that we will receive their liberal patronage. As the rates charged in that issue are the same as for our regular edition an advantage is secured, and an extraordinary opportunity offered to manufacturers for bringing their goods to the attention of a large class of readers at low cost. Those wishing desirable locations would do well to send in their orders as early as practicable as the demand for space is already large.

Rates will be promptly furnished to any one desiring same, upon application.

The Manufacturer and Builder for 1879.

The year 1879 opens full of bright indications for every business interest in the country, and to none are these hopeful signs more evident than among those represented by the MANUFACTURER AND BUILDER. The country once more seems to be emerging from its dark days of depression upon an era of universal prosperity. This year of renewed business activity also marks the entrance of the MANUFACTURER AND BUILDER, with this number, upon its eleventh volume, and in a new dress, the title-page used during the first three years of the publication of our journal being re-adopted, and the color of the cover changed to a brighter and handsomer hue; the body of the magazine has also been enhanced by the use of super-calendered paper, giving a highly improved appearance to both illustrations and letter-press. A change of title-page has long been in contemplation, and we finally concluded to adopt our old design in place of the one we have been using, considering it more practical and artistic than the latter, or any other that has been submitted to our consideration.

We wish now to say a few words regarding the history of our journal and our intentions for the future.

The MANUFACTURER AND BUILDER was started to supply a want that was felt for a mechanical and scientific monthly—one that should be practical, reliable, popular, and published at a low price. The success of the magazine was assured with the publication of the first number, and since then it has steadily continued to gain in public favor, until it has obtained its present enviable reputation in the field of technical journalism. The ten volumes already published are the best evidence of the fruits the MANUFACTURER AND BUILDER has produced during the years of its publication, and we think it must be conceded that, taken as a whole, these volumes present one of the most valuable cyclopædias of knowledge ever issued.

The numbers for 1879 will be characterized by the same valuable features that mark our former volumes, and care will be taken to render each department of the most practical value, including our department of Notes and Queries, in which hundreds of questions are answered every year upon all kinds of topics. This has always been a popular feature of our journal, and we shall continue to give it the same careful attention as in the past. We shall keep our readers, as ever, fully posted regarding the progress of science, of invention, and of matters generally coming within our scope; in fact, the MANUFACTURER AND BUILDER will retain all the features that have proved so acceptable in the past, and at the same time new attractions will be added as may offer from time to time, our purpose being to give our readers the best and most progressive journal published at the lowest possible cost.

We thank our readers and advertising patrons for the kind and generous support which they have accorded us in the past, and trust that we may receive the same in the future.

The Sugar Question.

In answer to an inquiry, and for the general information of our readers, we will give a short explanation of the present exciting question whether the sugar tariff —putting a duty on the importation of sugar, variable in amount according to the quality—shall be changed or not. It is proposed from some quarters to change this tariff and put an equal tax on all imported sugars, regardless of quality; this is strongly opposed by our sugar refiners and all those whose interest is similar.

In order to realize the magnitude of this interest, one has only to take into consideration the millions of dollars invested in extensive sugar refineries in the various large cities of the United States, the thousands of men employed, and the thousands of millions of pounds continually treated, thrown into the home market or exported of an article which has become a staple and a necessity in civilized life.

In order to understand the question, the reader should know that the tariff puts a heavy duty upon

white sugar, a lesser upon light brown, still less upon darker brown, and the darkest sugar, such as that of Bahia, pays the least duty. This, of course is not only in the interest of the home refining business, but also for the sake of common justice, as the darker sugars are not all sugar, but contain impurities, often to a very great percentage, and it would be an injustice to compel importers to pay duty on such impurities.

Among the imported sugars, those from the island of Cuba are the lightest colored, and hence have to pay the highest duty. It would, therefore, be in the interest of the manufacturers there, to have these duties lowered, and the present agitation in regard to this subject is due to their machinations in this country, for which, in order to bring them to a successful result, they have expended large sums of money.

The first move consisted in an attempt to impress our government with the idea that the Revenue Department was defrauded, by the refiners here declaring the imported sugar to be of a lower degree than was actually the case, in order to pay according to a lower scale of duty. It should not be lost sight of that in this case half a cent, or even a lesser fraction of a cent per pound, soon amounts to many thousands of dollars, by reason of the large quantities imported, amounting to millions upon millions of pounds. It is being attempted to sustain the theory of fraud by an accusation against the weighers—that they are paid by the importers to make false returns, and against the samplers that they have been bribed to draw out the samples from the hogsheads in such a way as to represent the lowest possible color, and that both weighers and samplers do this for a consideration. Another move in the same direction is the accusation that many kinds of imported sugars are artificially colored, so as to make them appear of a lower grade, for which less duty is paid.

It appears to be true that occasionally imported sugars have intentionally been colored with their own coloring matter, so as to make their shade deeper; but such cases have been very rare, and as a general thing importers and refiners have acted honestly and fairly. If it is proved that some of them have not thus acted, it is no more than just that their acts should be brought to light, and punished. But to follow the course the Cuban manufacturers and merchants are trying to force upon our government by their agents here—an equalization of the tariff—would be a gross injustice to all honest importers and refiners, and to the country in general, as it would not only ruin our large refining concerns, and throw the thousands of men they employ out of work, but annihilate one of the most important and extensive branches of our home industry.

To give the reader an idea of the great amount of sugar production and consumption, and the consequent importance of this industry, we insert the following paragraph, which, on account of the present sugar question excitement, is now going the rounds of the newspapers throughout the country:

"The World's Sugar Production.—The annual production of the sugar of the world has been approximately calculated as follows: Bengal, China, and Siam, 300,000,000 pounds; British colonies, 440,000,000; Spanish colonies, 470,000,000; Dutch colonies, 160,000,000; Swedish and Danish colonies, 20,000,000; French colonies, 160,000,000; France (beet), 360,000,000; Brazil, 150,000,000; Zollverein (beet), 550,000,000; Austria (beet), 178,000,000; Russia (beet) 100,000,000; Italy and Belgium (beet), 200,000,000; all other sources, including the United States, 400,000,000; total, 3,420,000,000 pounds. The annual consumption of sugar per head by different nations varies very considerably, as may be seen by the following figures, based on official data: In the United States, 33 pounds per head; England, 30; Scotland, 30; Holland, 16; Ireland, 5; Belgium, 6; France, 6.66; Spain, 6.24; Switzerland, 6; Portugal, 5; Denmark, 5; Poland, 5; Prussia (Zollverein), 10; Norway and Sweden, 9; Italy, 2; Austria, 2; Russia, 1."

We ought to mention that the statistics, as here given, are entirely unreliable at the present day; in the first place, they have been literally copied from the "Dictionaire des Alterations et Falsifications des Substances Alimentaires," by M. A. Chevalier, published in Paris in 1855, and are thus 24 years old. Surely the world has progressed, and the population largely increased since that time, and production as well as consumption in proportion also. Secondly, the figures have been reduced from kilograms to pounds on the basis that 1 kilogram is 2 pounds, which is slightly erroneous, as it is more than 2 pounds. If the reader increases all the above figures about 25 per cent, he will certainly be nearer the truth.

Adulterations of Sugar.

The fear of buying adulterated sugar has little foundation on actual facts, notwithstanding the newspapers from time to time are attempting to get up an excitement about it, by ridiculous statements that all the sugar we buy is adulterated with sand, marble-dust, chalk, gypsum, plaster, flour, starch, etc. Now, anybody by a little reasoning, who will look into the subject, will soon find out how little reality there is in all this, especially when he takes the trouble to examine sugar with the purpose of detecting such frauds; and he can do this without being a chemist. Everybody knows that sugar dissolves in water, and that sand does not; also that when you chew sugar it is easily crushed between the teeth, leaving nothing behind, and that when you chew sand it is gritty and sticks between the teeth, hence if sugar were adulterated with sand or marble-dust, it would not all dissolve in water or in the saliva of the mouth, as pure sugar does. All that has to be done to detect this adulteration is to dissolve the sugar in a glass of water and see if any residue is left, or what is simpler still, to chew some between the teeth, when the sand will at once show its presence by a disagreeable grittiness.

Dissolving the suspected sugar in water will also detect gypsum, plaster, and flour, as these substances are also insoluble, or at least very little soluble in water. If these substances are very finely ground, so that no precipitate is formed, they will leave the water milky; and when the quantity is very small, very little or no deposit may be obtained. But in order to ascertain which of these substances has been used for adulteration, hydrochloric acid is added; if the milkiness disappears, it is proof that gypsum, plaster, chalk, or some other lime compound is present, because that acid is a solvent for lime; if the milkiness does not disappear, it is probably flour or starch. In order to ascertain this with certainty, the solution is boiled and a few drops of an iodin solution added; if it colors the solution blue, it is flour or starch; not otherwise.

Of course the latter adulteration is harmless, so is that with chalk, gypsum, or plaster, if only present in very small quantities, as these substances are compounds of lime, and such substances are present in many articles of food we consume. They are contained in meat, milk, and many vegetables, and are, in fact, necessary for the human system, as our bones consist chiefly of lime. Chalk is a carbonate of lime, gypsum a sulphate of lime, and plaster is simply gypsum from which all water has been driven out by heat by a process of burning. Small quantities of lime are always present in the natural sugars, but in so small a quantity as not to be detected by the test here given. But in this case no harm will result, and it is absurd for newspapers to frighten the ignorant with false statements, such as one falling lately under our notice in which the constituents of gypsum or plaster were named as adulterants. These substances are chemically named sulphates of lime, and consist of sulphuric acid and lime, and, as is the case with all chemical compounds, entirely different in all properties from the constituent parts, the acid and the lime having neutralized one another totally, and produced a harmless compound. The paper in question names as adulterants of sugar, lime and oil of vitriol, (the old name for sulphuric acid), and of course persons unacquainted with chemistry, are frightened with the idea that they use quicklime and oil of vitriol in their sweetened coffee, tea, and puddings. Now it is evident that the so intensely sour oil of vitriol or sulphuric acid, could not possibly be an adulterant of sugar, neither could lime, as the first would make the sugar sour and its color black, while the second would make it bite the tongue.

The only adulteration which, with any chance of success and profit, can be used in sugar, is glucose or grape sugar, which is now manufactured by a chemical process from corn-meal, or any other cheap substance containing starch. Of course this adulteration is harmless, but unprofitable to the consumer, as this artificial grape sugar has sweetening qualities far inferior to cane sugar. As grape sugar is either brown or yellowish, and does not crystallize, it cannot be used to adulterate white crystallized sugar, but only the brown qualities.

It is not difficult to detect the presence of this adulteration, which is also perhaps more used for adulterating honey, maple sugar, and maple syrup, than for brown sugars. This test is based on the property of grape sugar to reduce copper from its salts when potash is present. If a solution of blue vitriol (sulphate of copper) is mixed with a solution of caustic potash, a solution of cane sugar will have no effect on it; but when grape sugar is present it will gradually decompose the copper salt, the potash will combine with the acid and the copper oxid be precipitated as a light brown deposit. Heating the solution will hasten this formation of the precipitate. We found that instead of caustic potash, any alkali, or carbonate or tartrate of an alkali, can be used, such as common washing soda; and that instead of blue vitriol, we may take tartrate of copper, so that the test succeeds as well if we prepare a mixture of 1 part Rochelle salts (tartrate of potash and soda), 1 part caustic potash, 1 part sulphate of copper in 20 parts of water. This solution will be clear and of a deep blue; it must be kept in the dark. It cannot only be used to detect the existence of the adulteration in question, but it has also been refined so as to determine the percentage of the adulteration, in order to learn how much grape sugar has been mixed with the cane sugar. This is done by first trying, once for all, how much grape sugar it takes to discolor a certain quantity of the blue solution. If then a test is to be made afterward, we introduce into an equal quantity of the blue solution the suspected sugar, very gradually, until discolored. The amount of sugar used to accomplish this must then contain as much grape sugar as was required before for the discoloration, and, comparing the two quantities, we have the percentage of adulteration.

Contrary to a prevailing opinion sugar refiners do not adulterate; if adulterations are found it is done by middlemen, who trade in sugars and try to profit in this way, but even this is seldom the case, and we state it as a result of our experience that it is difficult to find adulterated sugar in the market, and we are convinced that if we want such sugar, it will be necessary to adulterate it ourselves, by putting in marble dust, plaster, chalk, etc.

The daily papers contain several articles which show the just indignation of sugar refiners regarding the accusations of adulteration practised by them, and which simply emanate from parties to whom the ruination of our sugar industry would be of personal interest. The refiners demand a thorough and exhaustive analysis, and are willing to pay all expenses, in order to set the matter at rest, and clear themselves from unjust injuries.

It appears that Professor Chandler's assistant has found traces of tin, copper and free acid in sugar furnished by Mr. Earle, a dealer in that article; but on being interviewed by Mr. T. A. Havemeyer, one of our prominent refiners, Prof. Chandler acknowledged that refined sugars were not adulterated, while he said that the statement about "the copper ought to have been left out" so it appears his assistant made at least one mistake. In regard to the tin and acid, the refiners claim that their sugars leave the refinery absolutely unadulterated, and that this will be proved during a lawsuit, about these sugars, in which Mr. Earle is involved.

We will communicate the result to our readers.

Syphon Condenser.

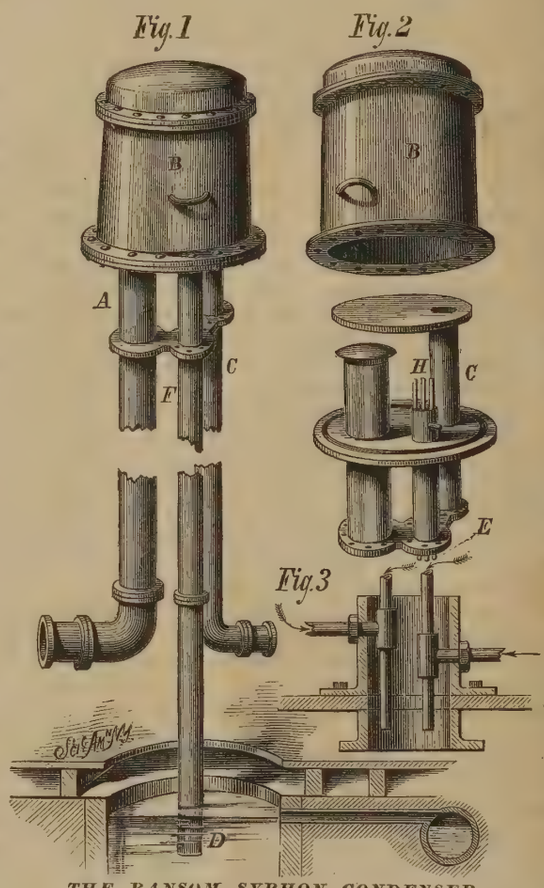
Most of our readers know that water cannot be raised in a suction-pump higher than about 32 feet, as a column of water of nearly that hight counterbalances the atmospheric pressure, and a continued action of the piston can do no more than maintain the vacuum over the water column.

But the reverse operation may be performed; instead of using a piston-pump to produce a vacuum, and so raise a column of water, a column of water may be made to descend, and, provided it is more than 34 feet long, it will produce a vacuum over it. Such a one is called a syphon vacuum. A vacuum thus produced may be profitably employed on a low-pressure steam-engine as a substitute for the air-pump and condenser, and to Dr. Frank Ransom, of Buffalo, N. Y., belongs the credit of having first applied this to the steam-engine. He has devoted twenty-five years to the perfection of this ingenious device, and has now applied it to more than one hundred steam-engines, vacuum-pans, etc. He takes a tube F (see Fig. 1) of say 34 or 40 feet high, places it vertically, with its lower end in the hot well D, and on top a vessel B, serving as a condenser. This latter vessel receives the exhaust steam from the engine by the tube A, while by C the ordinary injection of cold water into the condenser is accomplished.

In Fig. 2 the interior details are represented; the condenser B is seen lifted from its seat, and immediately under it is seen the peculiar arrangement of the upper ends of the tubes F, A and C, of Fig. 1. This peculiar arrangement was necessitated in order to get rid of the air, which will by leaks, etc., accumulate in the condenser, destroy its vacuum, and thus make it inoperative. The way in which this air is disposed of, is to cause it to mingle with the outflowing water; this is accomplished by the small pipes in the exit C, Fig. 1, and seen in Fig. 3 on an enlarged scale. These small pipes take water at or near the floor of the condenser through horizontal pipes tapped into the delivery pipe, (see arrows in Fig. 3), and take air at their upper ends. They discharge air and water mingled at the bottom of the delivery pipe in the hot well. In operation, the exhaust steam passes through pipe A into the condenser, and expands under the spray-plate, when it comes into contact with a spray of water from the pump or other source of supply through C. As the steam is condensed, its water, and the water of injection, heated to about 100°, fall to the floor and accumulate to the hight of the mouth of the small pipes, thus filling them with water; as this water rushes downward it creates a vacuum, which causes the air to pass down the small pipes, and thus the air is drawn from the condenser. As the water overflows the top of the large delivery pipe, it passes out and prevents any further accumulation of water. Thus the large delivery operates as a safeguard against flooding. These delivery pipes all carry out water mingled with air, and it has been found that the vacuum will be maintained by the outflow of the water necessary for the condensation of the steam used.

By these devices Dr. Ransom found that he could enlarge the crown of the syphon and divide the current of water without disturbing its outflow, and condense steam from an engine or vacuum-pan and make the outflowing current carry off all air incidentally introduced by the water, or by leaks in any part of the apparatus.

It is evident that this condenser, when once well arranged, requires no special skill or knowledge to operate it, as there are no injection cocks to attend to, and in fact it is claimed to add nothing to the ordinary care of a high-pressure engine. The amount of power required is stated to be only that necessary to keep the syphon running. Thus, at starting, the pump will have to lift the water the full hight of the condenser, but as the vacuum increases, the labor on the pump diminishes. Thus, if the condenser is 34 feet above the hot well, and the vacuum at 26 inches mercury, (the usual range), the siphon would lift the water nearly 29 feet, reducing the labor on the pump to a lift of 5 feet. When a head or fall of water of 15 feet can be had, no pump is required, and the vacuum can be maintained indefinitely. Should a steam-pump be used, it can exhaust also in the condenser, and will act as an independent motor, leaving the total value of the vacuum net to the engine. In this case the vacuum may be formed before the main engine is started, which is often of great value on large engines. Extensive use at the West has demonstrated the value of this condenser in gritty water, where an air-pump could not be used. Speed of the engine attached to the condenser is no objection, as under proper construction the vacuum will be steady at any speed, and heating of the condenser cannot occur, as the water must pass through constantly. It has been successfully applied to lake and river steamers, to vacuum-pans for sugar, dye-stuffs, etc., and is applicable to all purposes where a vacuum can be used. It is claimed that such a syphon condenser, which makes the air-pump unnecessary, will, under certain circumstances, involve a gain of from 25 to 40 per cent, which means that the engine will, with the same amount of fuel, do so much more work, or that doing the same amount of work, so much fuel may be saved.



THE RANSOM SYPHON CONDENSER.

The manufacture of this arrangement, protected by patents, is now in the hands of the Ransom Syphon Condenser Company, who have secured an improvement which consists in the use of this syphon in connection with the utilization of the force of the exhaust steam upon the falling column of water, combining the principle of the syphon with that of the ejector. This ingenious improvement we will illustrate in a future number.

The address of the Ransom Syphon Condenser Company is 57 Broadway, (Room 21), New York; Mr. T. Sault, General Agent.

POCKET LEVEL.—The *Praktische Maschinen Constructeur* describes a simple pocket level, patented in Germany by Baumeister Bohne, of Charlottenberg. It consists of a cylindrical box two inches high and one and a half in diameter, with openings for two plane glasses. The axis of the level is immediately brought into a horizontal position by a weight suspended from the lower part of the inner portions of the instrument, which hangs in a universal joint (Cardano's swing). It has a small Galileo telescope, which shows the object looked at and at the same time gives the magnified picture of a micrometer scale. To effect this the concave ocular is combined of a finely pierced biconcave and a plane-convex lens. The small central portion of the latter acts as a magnifying glass, while the rest acts in the ordinary manner. The weight may be arrested by a rod running through the handle.

American Machinery in Brazil.

The Boston *Commercial Bulletin* says: "Notwithstanding the superior finish and adaptability of American machinery, there is a strong prejudice against it in Brazil, because of its lightness and delicacy. The clumsy, heavy machines of European manufacture have educated the people into the belief that those of lighter construction used in the United States are only fit for amateurs, and are not strong enough for the requirements of their own country. While it is not advisable for Americans to make any general change in the weight of the machines constructed for the Brazilian market—as these very objections now urged will in time become the distinguished features in its favor—there are yet individual cases in which the objections are well taken. As an instance, many of the machines used in woodwork have been found to be too light for the hard, tough wood of that country, and, notwithstanding their many acknowledged merits, they have been rejected for machines and methods totally inferior in every respect. If the requirements and prejudices of the Brazilians are intelligently consulted, supplemented by the necessary patient and painstaking method of bringing them into public notice, a large trade in certain classes of American iron machinery will be secured there."

Tasmanian Tin.

Tasmania is rapidly becoming a second Cornwall in the quality and extent of her tin supplies. Four years since the value of tin and tin ore exported from the colony was barely $35,000, while in 1877 the value of tin exported was nearly $1,350,000, while the trade has received a fresh impetus in the discovery of a new lode-bearing district. Until recently the principal portion of tin produced in Tasmania was obtained by the ancient process of "streaming" or washing the sand and earth in water, and allowing the heavier metallic parts to subside, but by the discovery of lodes at Mount Bischoff, the colonial miner has been enabled to compete on equal terms with his fellow craftsman in Cornwall. The mining district of Mount Bischoff has now found a rival in a tin mountain at Mount Heemskirk, on the West Coast. The "wash dirt" is some 20 ft. thick, and produces about 25 per cent of tin; but the existence of solid seams of the metal, traversing the mountains in veins several feet in depth and width, has thrown even these productive workings into the shade. Some nuggets weighing several cwts. each have been found, yielding nearly cent per cent of pure metal. Mixed with the tin, too, is a small quantity of gold, which adds considerably to the tin miner's profit.

CONDUCTIVITY OF HEAT.—Some recent investigations concerning the coefficient of conduction for heat of various building materials—excluding the influence of radiation, and making measurements by means of the thermo-electric multiplier—show that stones are much better conductors of heat when wet than when dry, and that various classes of them, such as marble, sandstone, granite, etc., have approximately the same coefficients of conduction, while dry bricks of all kinds are much worse conductors than the natural stones.

Bolt-Cutting Machines.

Screw-bolts are used for many and varied purposes, hence by the steady and great increase of industrial pursuits the demand for them has become simply enormous. At first, of course, they were made on ordinary lathes, but the great quantity required by the trade soon made it necessary for manufacturers to employ special devices to make them, and hence the invention of bolt-cutting machines, which, as our engravings show, are nothing but lathes, adapted for the special and exclusive purpose of bolt-cutting. Such a machine as at present perfected and represented here, will greatly surpass the ordinary lathe in the rapidity with which the work can be accomplished, as it cuts the complete thread in one operation, instead of many, as required with the lathe tool. Besides the great saving of time thus obtained, it makes a more accurate and uniform thread than can be obtained on an ordinary lathe tool, ground and set by the eye of the average machinist. The reason is simply that the cutting teeth of the dies are formed by tools especially constructed for this purpose by an expert. While bolts will vary when made by the slow process of a lathe, they will be perfectly alike, even when made rapidly by the thousand, on a bolt-cutter with firmly-held dies.

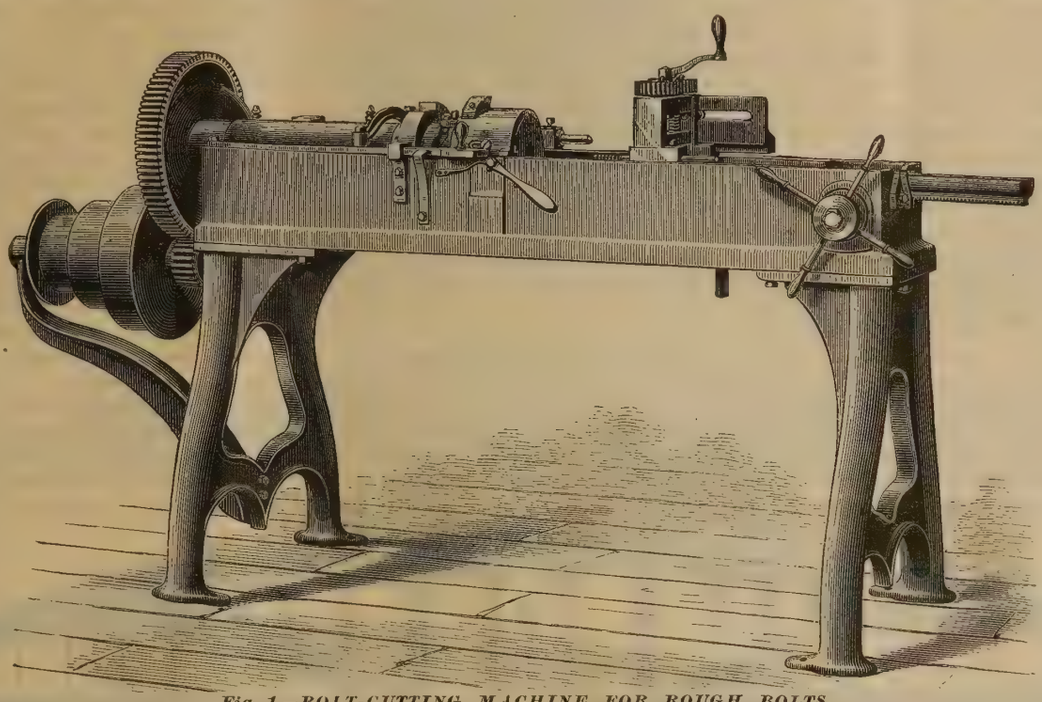


Fig. 1.—BOLT-CUTTING MACHINE FOR ROUGH BOLTS.

The bolt-cutters here represented can be made to thread every lot of bolts to any fixed length desired, open the dies at that point, and throw back the bolt, when the dies close again to receive the next bolt; they are therefore automatic. The dies do not cut on the principle of the old-fashioned jam-plates of the blacksmith-shops; this is the case with many bolt-cutting machines still in use, in which the upper part of the thread is raised by sideward pressure; but in this machine they cut out the stock the same as is done in clean cut bolts made on the lathe, hence a rapid, easy, and clean cut is always obtained. This is accomplished by the dies containing four solidly fixed cutters, which cut in the same way as the tool in a lathe, which has the cutting edge placed in the most favorable position for easy and smooth cutting. In this machine they are set with their upper side directly in line with the center of the bolt, and instead of jamming the bolt, as is the case with other cutters, it moves freely, as the groove is cut, and not scraped out by friction. It is evident that there can be no abrasion of the thread of the bolt, no breakage of the same, as there is no strain, and no other breakage by neglect of the operator should he run the carriage against the cutter-head, as is the case with machines which are not automatically operated.

Other advantages are, that the dies are interchangeable, and any set will fit any machine of the same numbered size; they can be sharpened easily, and re-cut with the hobs or master taps sent with each machine. They are furnished for regular V threads of the United States standard; but there is an adjusting arrangement by which they can be set for a little smaller or larger size of stock or for wear. Also for square threads dies are furnished, and are the only ones cutting such threads with once going over. As the spindle is hollow, bolts of any length can be cut, while the nuts are made by attaching the tap to the cutter-head and holding the nut in the bolt-vice, so that it is also a complete nut-tapping machine. A receptacle catches all the oil for re-using. Finally, a boy or unskilled workman can operate it, and even attend to two or more of these machines.

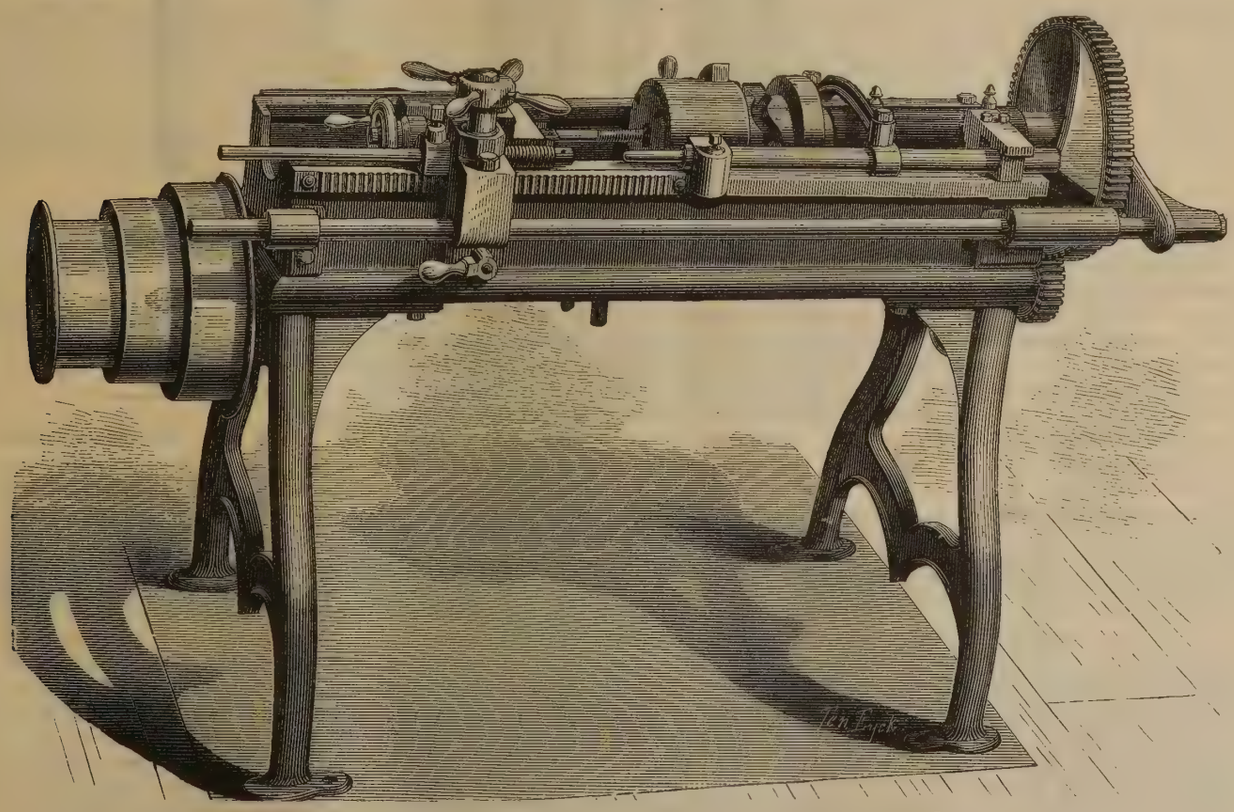


Fig. 2.—BOLT-CUTTING MACHINE FOR FINISHED BOLTS.

For threading finished bolts, so that the nut will come at exact right angles with the axial lines, and to make accurate fits on finished work, it has thus far been considered necessary to cut the thread in a lathe, where the bolt can be held in correct line by the centers, as otherwise the dies following the surface are guided by

its varying size, shape, and texture. In order to accomplish this on the bolt-cutter, the manufacturers patented in 1874 a device to secure the same correct relation of the thread to the axial line that is obtained when cut on the lathe. This makes it a bolt-cutter for finished bolts, and the success was so complete as to leave nothing to be desired.

These machines were made by the Wood & Light Machine Company, of Worcester, Mass., and may be obtained at the George Place Machinery Agency, 121 Chambers and 103 Reade streets, New York. This concern have a large number of these bolt-cutting machines for sale, both new and second-hand, at very low prices, descriptions of which may be found in our advertising columns. Besides these machines, a great variety of other machinists' tools, second-hand as well as new, can always be found at this establishment.

Hydraulic Pressure Moving Draw-Bridges.

When a draw-bridge is very large or heavy, it becomes impossible to move it by hand-power, as is done with comparatively smaller draws; even the gearing applied to many draws of middling size, and which make it possible for two or four men, acting on levers properly arranged, to move such a bridge by walking in a circle like sailors around a capstan, becomes utterly inadequate for very large bridges. For this reason, on several large bridges across the Mississippi, and other large rivers, a steam-engine is required, and applied with perfect success. It is evident, however, that in localities where hydraulic pressure is disposable, as is the case in cities with water-works to apply the hydraulic pressure, and as bridges are generally placed on the lowest level, there is always a good head of water, and consequently a sufficient pressure to supersede steam pressure, being almost always some 50 pounds to the square inch on an average, and in some localities it reaches 100 pounds, and even more.

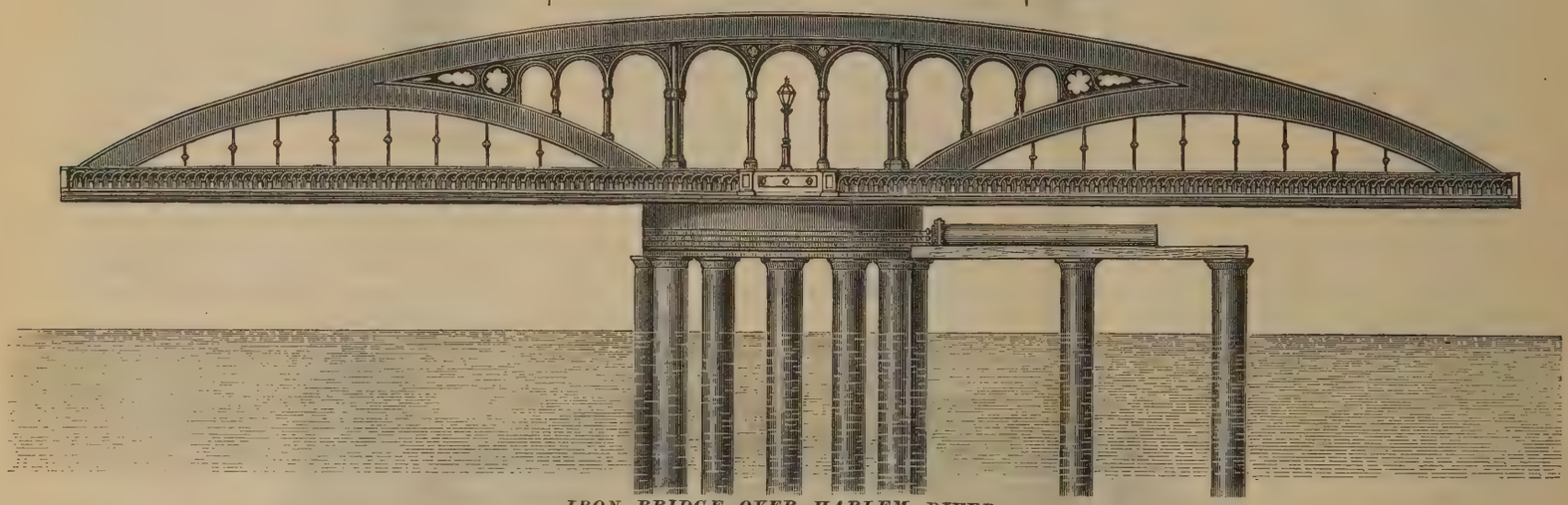
Advantage is actually taken of these circumstances, doing away with the great cost and care of a steam-engine and boiler, and requiring nothing but an attendant to turn the water on, when the bridge is moved with a steady motion. One of the first bridges of this kind ever constructed was the Third avenue bridge over the Harlem River, New York city, which is represented on this page. It is built entirely of iron, even the foundation pier, which consists of 12 hollow iron columns, which were sunk through the mud of the river bottom, until the solid rock bed was reached, and then filled with concrete. At the top these columns are connected with a crown piece, which contains two turbine engines, one for opening and the other for closing the bridge. They are revolved by a current of water from the Croton water-works; and by suitable gearing they can be made to open or close the bridge by simply turning on the water for the one or the other.

It is well known that notwithstanding a good turbine is the most economical of all water-wheels, there is a waste which may range from 10 to 30 or 40 per cent of the power employed, while if the existing conditions allow us to employ the mere pressure of the water, without expending a portion of it to produce a rapid rotation, things may be so arranged as not to be subject to any perceptible waste at all. This is exactly what is now done for opening and closing draw-bridges. When this work is to be performed by steam-power, it is done in the same way as hoisting—in fact, a hoisting engine is made to do the work of turning the bridge instead of lifting a load; but it is bad economy to follow this same principle, when we have water-power, and to substitute for the hoisting engine a turbine wheel, and to retain all the complex gearing for the transmission of power and the transformation of a rapid into a slow, powerful motion; it would be much better simply to use the pressure of the head of water, and to let this act in the direction of the desired motion, without the intervention of gearing or its equivalent.

This very thing has been accomplished by Mr. William Burdon, of the Burdon Iron-Works, Brooklyn, N. Y., already so favorably known for his hydraulic elevators, which also work by simple hydraulic pressure. The figures on the opposite page illustrate the manner in which he applies it to a draw-bridge. The upper figure gives a side view of such a bridge when closed, the motion being produced by the hydraulic pressure of the water on pistons in cylinders. The middle figure represents a ground plan of the center pier, the bridge itself having been removed so as to expose the rim with rollers on which it rests. There are four cylinders and pistons; the latter act on the revolving rim by means of heavy flexible wires, which pass through a packing in the cylinder-head. When the water is turned on so as to admit it to two diagonally opposite cylinders, its pressure will produce a pull on the wires, and these, being fixed to the revolving rim, will rotate it, and with it the whole draw, which rests on it. When the bridge has to be closed again, the water is turned on into the two opposite cylinders, while the same motion which turns on the water in two of the cylinders gives an exit to the water which has filled the two others. In the upper figure at the right hand side the attendant is represented in the act of turning on the water in two of the cylinders, so as to open the draw, while the same wheel gives exit to the water in the other cylinder, which is seen flowing out just below him. The dotted lines in this figure represent the direction of the water-pipes through the masonry to the cylinder-heads, which pipes are also seen under the river bottom, and more distinctly in the middle figure, one pipe crossing the water for carrying the pressure to the cylinders which serve for opening and the other to close the draw. The lower figure represents the bridge when open, resting entirely on the center pier, which is here seen longitudinally.

There is no doubt that this is the most economical way to move a draw-bridge, as well in regard to first cost as to maintenance. As the cylinders are 16 inches in diameter, or 200 square inches surface, a head of say 100 feet of water, which corresponds with 50 pounds pressure, will exert a pressure of 10,000 pounds, or 20,000 pounds or 10 tons for the two cylinders—amply sufficient to overcome any friction, which is all the resistance to be overcome, and which by good construction of rollers and rails on which they move, may be easily reduced to a minimum.

Another incidental advantage is that by this process a draw may be opened much more quickly than by the process of using a turbine and gearing, in which case the draw can only be moved with a certain and very slow velocity. Experience has shown that this slow motion has given rise to many accidents, often involving expensive damages, as a rapid motion, or an acceleration of the motion, is beyond the control of the operator. By this invention of Mr. Burdon, the attendant can move the draw with great velocity if required, and can very quickly increase or diminish the velocity, if circumstances require, or stop its momentum altogether. There is also no danger of damaging the machinery by a quick stoppage, as, in case the hydraulic pressure were suddenly reversed, the momentum of the bridge would only for a single moment press the inflowing column of water backward, but soon yield to its steady pressure, and move in the direction required. In short, there is undoubtedly no method by which the motion of a draw-bridge can be kept better under control than the one here described, and we congratulate Mr. Burdon on the happy thought of applying simple hydraulic pressure for this operation, for which this source of power is so eminently adapted.

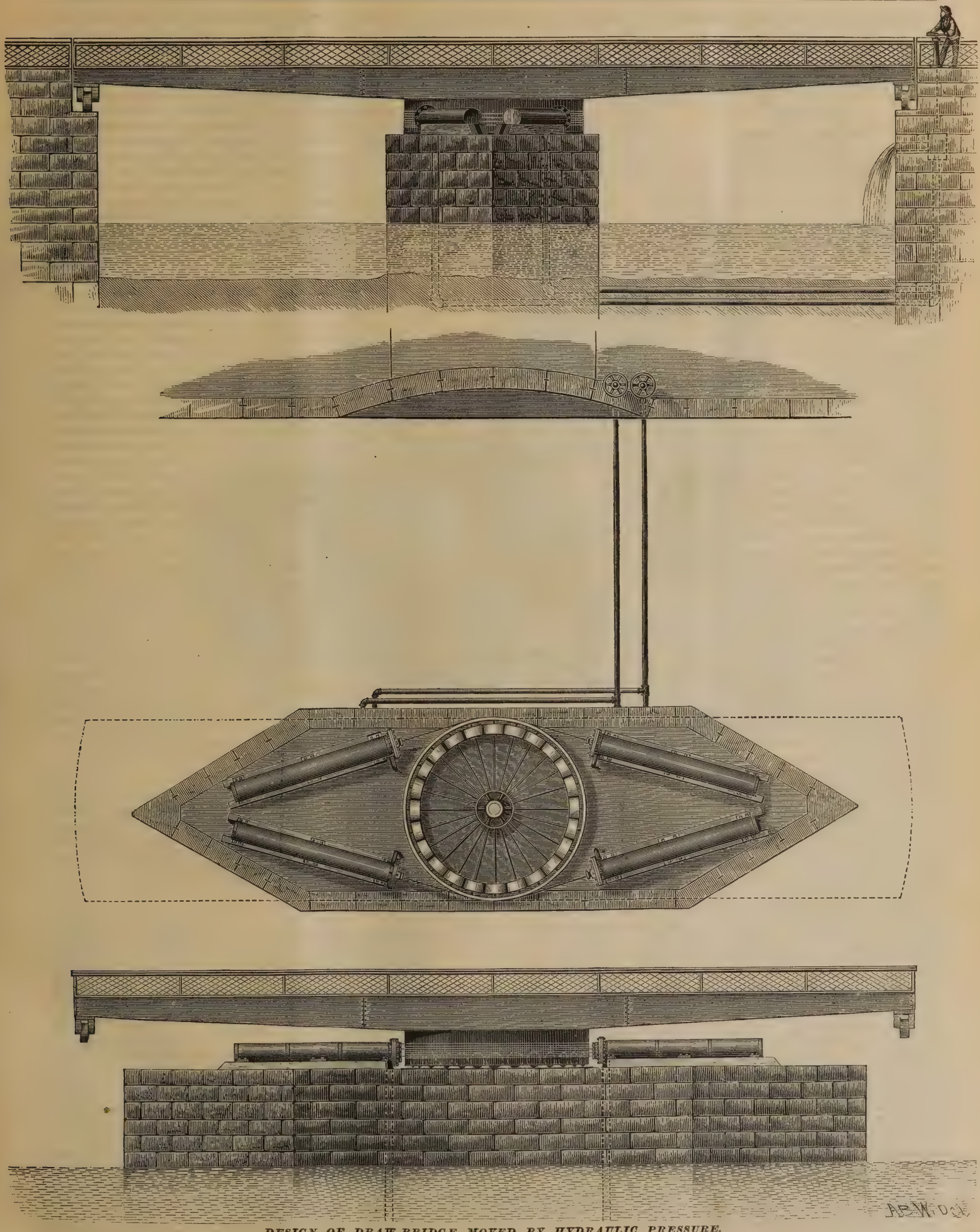


IRON BRIDGE OVER HARLEM RIVER.

A New Shingle Machine.

A new machine for manufacturing shingles has recently been invented, and the shingles produced by it bear such striking evidence of superiority over ordinary sawed shingles that the machine cannot fail to attract attention wherever exhibited. Instead of being sawed, the shingles are cut from the "bolt" by a huge knife, which leaves them as smooth as if planed, and without a particle of "check" or liability to split. Many attempts have heretofore been made to make the cutting of shingles in this manner practicable, but have proved failures from the fact that the shingle would be weak and "shaky" from the effect of the cut. The invention in question overcomes this difficulty, and the result is a most perfect shingle. They are cut riftways, it being impracticable to cut a bastard shingle by this process.

If the machine, when put into every day service, fulfills anything like the inventor's expectations, and they are certainly warranted by actual tests so far, his will be the only shingle machine sold in the future. There being no saw kerf, the saving in timber alone amounts to more than one-third, while the inventor



DESIGN OF DRAW-BRIDGE MOVED BY HYDRAULIC PRESSURE.

claims one-half, which would make any machine pay for itself in a few days' run from this source alone. One machine will cut 75,000 shingles per day easily with one man, and get them out of the same amount of timber required to saw 50,000, making a clear saving of 25,000 per day, according to the inventor's showing.

Building Intelligence.

NEW YORK CITY.

IMPORTANT PROJECTED BUILDINGS.

Southwest corner Canal and Church sts, 5-story brick store and lofts; cost, $12,000; John B. Snook, architect. Nos. 351 and 353 East 61st st, 5-story brick factory; cost, $11,000; John McIntyre, architect; Connoly & Son, builders. North side 26th st, 300 ft east 1st av, 1-story brick pavilion attached to Bellevue Hospital; cost, $10,500; J. M. Dunn, architect; M. B. O'Meara, builder. Northwest corner 57th st and 9th av, two 5-story brown stone tenements; cost, $20,000 and $8,000; Theo. G. Smith, architect; John Ruck, builder. South side 70th st, 192 ft east 5th av, 3-story brick stable; cost, $18,000; E. Sniffin, architect; Joseph Smith, builder. North side 80th st, 375 ft west 1st av, five 3-story brown stone tenements; cost, $10,000 each; J. C. Burne, architect; Jas. Frame, builder. No. 273 West 10th st, 4-story brick and iron tenement; cost, $16,000; Robert Mook, architect. South side 54th st, 125 ft east 5th av, 4-story brown stone dwelling; cost, $10,000; D. & J. Jardine, architects; James Frame and James Mitchell, builders. Nos. 42, 44 and 46 Thomas st, 7-story brick warehouse; cost, $30,000; L. N. Crow and Grissler & Fausel, builders. No. 310 East 55th st, 4-story brown stone tenement; cost, $11,000; Wm. Graul, architect. No. 126 West 26th st, 5-story brick and Ohio stone stores and tenements; cost, $10,400; Thom & Wilson, architects; Samuel Lowden and Grissler & Fausel, builders. Nos. 20 & 22 East 65th st, two 4-story brown stone dwellings; cost, $13,000 each; Bussell & Wray, architects. No. 54 East 4th st, 5-story brick store and dwelling; cost, $10,750; F. W. Klemt, architect.

BROOKLYN, N. Y.

IMPORTANT PROJECTED BUILDINGS.

South side Willoughby av, 225 ft west Throop av, five 3-story brown stone dwellings; John Hayer, builder. North side Breevort place, 89.7 ft west Bedford av, six 3-story brown stone dwellings; Robert Dixon, architect; John S. Frost builder. South side McDonough st, 145 ft west Hopkinson av, two 2-story frame dwellings; Walter Laidlaw, architect; C. M. Trimble, builder. North side Gates av, 156 ft west Nostrand av, 3-story brown stone dwelling; Jas. A. Thompson, builder. South side Putnam av, 90 ft west Marcy av, fifteen 2½-story brown stone dwellings; T. W. Swimm, architect; D. Cunningham, builder. South side Halsey st, 250 ft east Stuyvesant av, three 3-story brown stone dwellings; J. V. Smith, architect; C. Cameron, builder. North side Macon st, 250 ft east Stuyvesant av, three 3-story brown stone dwellings; J. V. Smith, architect; C. Cameron, builder. North side Madison st, 156 ft east Bedford av, three 3-story brown stone dwellings; Charles Isbill, builder. South side Prospect place, 265 ft west 6th av, two 2-story brown stone dwellings; R. Dixon, architect; J. Gordon, builder. East side Strong place, 80 ft north Degraw st, three 3-story brown stone dwellings; G. L. Morse, architect. South side Greene av, 280 ft east Franklin av, eight 3-story brown stone dwellings; Parfitt Bros., architects; Levi Fowler, builder. South side Greene av, 240 ft west Tompkins av, three 2-story brown stone dwellings; Stephen Philips, builder. South side Fulton st, bet. Brooklyn and Kingston avs, 1-story brick and iron car-house. North side Hope st, 172.6 ft west Lee av, two 2 and 3 story brown stone dwellings. North side Madison st, 83 ft west Tompkins av, 3-story brown stone dwelling; J. D. Hennessy, architect; P. Sullivan, builder. Southeast cor. Pierrepont and Clinton sts, 4-story brick and terra-cotta library; George B. Post, architect; D. H. King, Jr., builder. South side Fulton av, 200 ft east Franklin av, seven 4 story corner brown stone tenements; Parfitt Bros., architects. West side Vanderbilt av, 677.6 ft north Myrtle av, five 3-story brown stone dwellings. South side Halsey st, 160 ft east Tompkins av, two 2½-story brown stone dwellings; Miller & Williamson, builders. North side Hewes st, 266.4 ft west Harrison av, 3-story brown stone dwelling; F. C. Vrooman, builder. Southeast cor. Franklin av and Hancock st, six 3-story brown stone dwellings; A. Hill, architect; W. J. Rider, builder.

GENERAL BUILDING NOTES.

The Presbyterians are building a church at Brownsville, Oregon.

Charles Greer is to build a new house at West Wareham, Mass., on the site of his old one, which has been removed.

Mr. H. J. Preston, of Boston, is the architect of a residence, in the modern Gothic style, for Mr. Geo. N. March, at Watertown, Mass.

A new public school building is to be erected in Granby, Mo., at a cost of $3,500. It will be a frame building, three stories high.

Messrs. Anderson & Hamilton, of New York, are the architects of a cottage now building for Mrs. E. G. Hartshorn, at Newport, R. I.

Mr. J. P. Putnam, of Boston, is the architect of a house for Mr. George Pierrepont, at Nahant, Mass. The builders are Phillip & Killam, of Manchester.

James W. McLaughlin is preparing a design for a new office building, to be erected by the heirs of the late Samuel Wiggins, on the southeast corner of Fifth and Vine streets (Fountain square) Cincinnati, Ohio, the coming spring. It will be a stone front, seventy-five feet on Vine by ninety feet on Fifth street, six stories. The building will have a frontage of ninety feet.

A Roman Catholic church is to be built at West Oakland, Cal. The church will be on Seward street. The front will be 67 feet wide, and the length of auditorium 100, a clear span roof and circular sanctuary. The tower will be two hundred feet high, but its erection is deferred for the present. The gable will be surmounted by a Celtic cross, which will be 100 feet from the official city grade; the side walls 40 feet high, from floors to eaves of roof; the hight to ceiling inside, 73 feet.

Mr. R. J. Dobins, builder, has now in course of erection on Broad street, above Vine, Philadelphia, a building designed to be used for holding fairs, receptions, and other entertainments. It will have a frontage on Broad street of 164 feet, and will extend in depth on Wood street 166 feet. The roof will be supported by 100-foot trusses, placed 14 feet apart. A gallery, provided with three ranges of seats, will run along the four sides of the interior. The front on Broad street will be of pressed brick, and will be two stories high.

A large tract of land on Seventh avenue, extending from Twelfth to Thirteenth streets, Brooklyn, N. Y., and running back several hundred feet, was recently purchased by the Ansonia Clock Co., which has begun the erection of a large factory. It will be built of brick, and will be 200 feet square and five stories in hight. It will contain a 250-horse-power engine and new automatic machinery for the construction of fine clocks of every description. Between seven and eight hundred workmen will be employed. This factory is expected to be in operation by May, 1879. The situation of the new factory is considered a most eligible one, as it is in a growing part of the city, where rents, nevertheless, are moderate. It is within two blocks of Prospect Park, and commands a fine view of New York Bay. The land on which the factory is situated cost about $33,000.

Among the costly residences lately erected in this city one owned by J. A. Bostwick, of the Standard Oil Works, is especially notable, as far above the average of up-town dwellings, having been constructed by day's work, and containing all the latest improvements and adornments. The site, which measures 50 by 150 feet is one of the choicest in the City, being located at the corner of 5th avenue and 61st street. Work was begun in the Spring of 1877, and the foundations were built up from the solid rock to within six inches of the cellar floor level, and were then covered with felt and asphaltum to prevent the rising of any dampness throughout any part of the structure. The house is built in the French Renaissance style, with Connecticut brown stone elaborately carved. The entrance on Fifth avenue is extremely artistic, having two square red Scotch granite columns, worked in Scotland, from designs prepared here. The columns are capped with female figures cut in brown stone, which add greatly to their ornamental appearance. Above is a semi-circular oriel window with pointed roof; a pair of ornamental brackets supporting the whole window. The Mansard roof, made entirely of iron and slate, has two bay-windows on the side; one running up to the roof, forming a tower and giving a handsome sky line. Careful attention has been given to the ventilation, and this is one of the prominent features of the house. All the foul air is drawn up from every apartment in a heated magazine, and then discharged above the roof, while fresh air is brought in through a tower 50 feet high and 4 feet square, carried under the yard into the cellar, where it is heated and then diffused throughout the structure. This prevents the introduction of impure air and dust. The heating is by steam, and the roof and the sidewalk and stoop are provided with rows of steam-pipes underneath to prevent the accumulation of snow and ice. There is also a complete network of electric wires. The stable and coach house on Sixty-first street is separated from the residence by a well laid out and flagged yard 30 by 60 feet. The building with its appurtenances has cost nearly $200,000.

BUILDING IN NEW YORK IN 1878 AND PREVIOUS YEARS.

During the year 1878 1,367 new buildings were begun and 1,247 completed. Of the 753 plans submitted during the year, 703 were accepted and fifty rejected. The total number of buildings included in the record presented for the year was 1,672. On the 31st December, 1878, there were 741 buildings going up as against 726 last year. During the year 1,121 plans for alterations were offered affecting 1,209 buildings, at a total outlay of $2,621,046. For the year, 1,102 alterations were begun and 1,112 completed, and at the close of the year 117 pieces of work were in progress.

Seventy-seven unsafe buildings were taken down during the year, and in the thirteen years, from 1866 to 1878 inclusive, 1,024 were made safe, and 696 buildings were entirely taken down. The assistant in charge of the Fire-Escape Bureau reports a total of 1,500 buildings provided with fire-escapes during the year.

Subjoined is an exhibit of the doings of the department and of the building in the city for the past sixteen years:

Year.	*No. of buildings.*	*Estimated valuation.*
1868	2,014	$34,517,068
1869	2,342	40,352,058
1870	2,351	34,668,998
1871	2,782	42,585,391
1872	1,782	27,884,870
1873	1,311	24,936,535
1874	1,388	16,667,417
1875	1,406	18,226,870
1876	1,379	15,903,880
1877	1,432	13,365,114
1878	1,672	15,219,680
Totals	19,811	$284,328,495

In the eleven years one hundred millions have been spent on 6,270 first-class dwelling-houses, seven millions on 1,921 dwelling-houses of the second class, nine millions on 485 flats, ten on 26 hotels, eighty on 7,041 tenements, thirty on 1,166 stores, eight on 68 office buildings, eleven on 1,100 workshops, two and one-half on 60 school-houses, five and three-quarters on 107 churches, twelve and three-quarters on 100 public buildings, a million on 1,070 stables, and half a million on 3,971 frame buildings.

Safe Elevator Engines.

The frequent accidents which from time to time happen with elevators intended to carry passengers, as well as those to hoist freight, have led to a careful investigation as to the various causes of danger connected with these now indispensable contrivances. Several inventors have suggested precautionary appliances, and many of these have come into use and given more or less satisfaction. It is evident, however, that some kinds of elevator engines have an inherent element of danger, which no additional safeguards to the car or hoisting gear can entirely remove; while other engines may, from the nature of their construction, be more safe, being designed and executed on better principles.

Of the latter class, engines intended to run passenger and freight elevators stand foremost; one has recently been brought out by Messrs. Cooke & Beggs, of 6 Cortlandt street, New York, and is represented in the adjoined engraving, (Fig. 1). It is seen to consist of a double vertical engine, coupled at right angles upon a shaft, with a belt-pulley between the connections. The belt works the winding-drum seen at the left, and is kept moderately stretched by an idle pulley running against it.

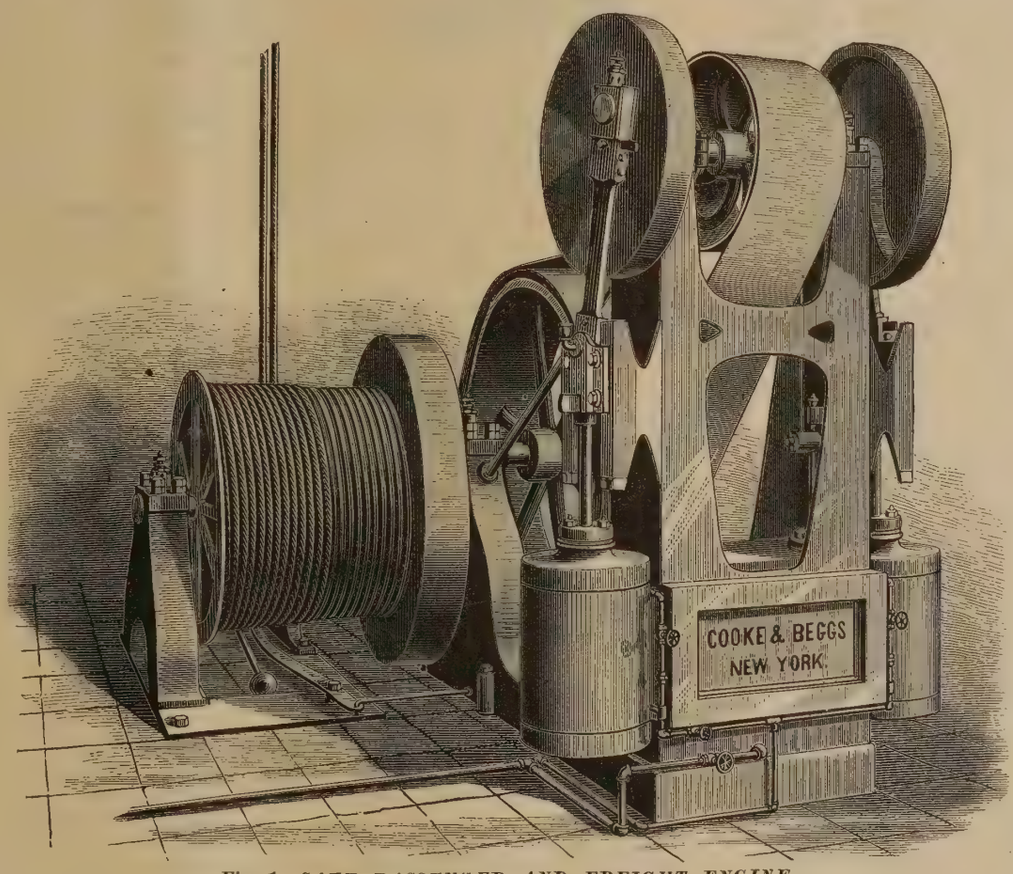


Fig. 1.—SAFE PASSENGER AND FREIGHT ENGINE.

In order to prevent winding too high or lowering too far, a device has been attached, constructed on the principle of a tumbler-lock, and is represented in Fig. 2. It consists of several disks hung upon a shaft, each one of which is provided with a stop. At each revolution one of them is carried forward, or "picked up," by the shaft, until the last one is reached. This immediately throws over the reversing lever, stopping the engine, and at the same time, by the action of a weighted arm, trips what may be termed a toggle-joint friction clutch upon the driving-wheel of the drum, Fig. 3, stopping the machine and cage at the same moment. A very neat apparatus also trips this toggle clutch whenever the rope unwinds from the drum, so as to have the coils loose or out of their proper grooves. This is accomplished by means of an apron extending across the face of the drum, and just far enough away from it to clear the rope. When a coil falls out of place or runs slack, it strikes the apron, and in doing so trips the catch by which it is held, allowing the apron to fall down. In doing this the weighted arm throws the toggle-joint friction clutch into play, and at once stops the drum. In such a case it is stopped under full-boiler pressure. This idea is one that does not show its value at first sight, but which is eminently reliable, therefore the practice has found favor with some of the best engineers in the country. For example, in Bessemer machinery, the engines for supplying the water pressure are made strong enough to come to a dead stand under full-boiler pressure when the resistance of the hydraulic pumps reaches a certain point. This is by no means difficult, and when done secures the engine from a great many dangers.

A plain slide-valve is used for reversing the engine, and is perhaps the neatest and most reliable method to accomplish this. The valves themselves are of easy access by simply removing the cover.

In regard to the practical features in the construction of this engine, we must state that the soft babbit metal has been discarded, and that the bearings are all of hard brass; that the bolt-holes are reamed true and turned to fit them exactly; that the cross-heads are made from a solid block of hammered iron, and have adjustable jaws, so as to take up the wear; the car hangs on four wire cables, and has safety pawls; and, finally, that the brake is constructed in such a way that the power is applied on both edges of the large pulleys, in the edges of which V-grooves are turned, the brake-shoes being made to conform to the grooves. These shoes are applied and released simultaneously by the toggle-lever. While this form of brake has a great surplus of power, it relieves the machinery from lateral or twisting strains, to which the old form of brake subjects it. When the lever is in position to open the steam-valve and start the engine, the brake is released at the same time, and when the lever closes

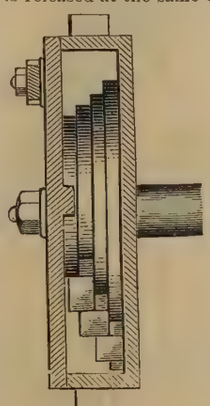


Fig. 2.

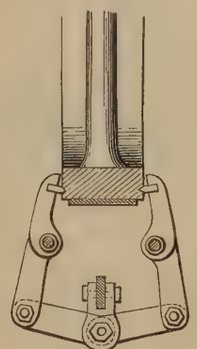


Fig. 3.

the valve the brake is applied. The automatic stop which prevents overwinding can be made to work at any point. At the same time it does not put any friction upon the car in starting in the opposite direction.

These engines have already earned a great reputation, being approved by expert engineers; one has been put up in the new Hahnemann Hospital on 4th avenue and 67th street, and one in the Broadway National Bank building, on Broadway, this city, where they may be daily seen in successful operation.

Locomotives without Fire.

Machines on the above-named principle are now at work on the tramway from Rueil to Marly, near Paris, and with very satisfactory results. The system in use is one introduced by M. Francy, an engineer, and is based on the fact that water boils at a low temperature proportionally to the reduction of the atmospheric pressure. Most of our readers are aware that although water requires a heat of 212° Fah. to boil at the level of the sea, a much lower temperature is sufficient to produce the same effect on the top of a mountain. We will now explain how that physiological fact is practically employed. Into a reservoir of thin steel (we cannot call it a boiler, for it has neither fireplace nor fire) is introduced 1,800 liters of water at a temperature of 400° Fah., and then covered up hermetically. The steam it gives off at once fills the superincumbent space, and produces a pressure of 15 atmospheres. As soon as any of the vapor is turned on for moving the machine the pressure is reduced, and the water then begins to boil, producing a fresh supply of steam. Of course that process is of but limited extent, as at the commencement the liquid only contained a certain amount of heat, which is gradually diminished as the reproduction of steam takes place at a lower temperature by the exhaustion of the superincumbent pressure, so that a machine of this description would obviously be totally inadequate to any very prolonged journey. But for short transit it has been found extremely serviceable. As the amount of pressure required to work the engine is only 5 atmospheres, a series of valves is so arranged as to prevent a greater amount of force issuing from the reservoir than is necessary, and thus retaining as far as possible the heat originally contained in the water. The driving part of the machinery is nearly identical with that of ordinary locomotives, with a few modifications, for the purpose of guarding against the useless waste of the heat originally introduced into the reservoir.

Decoration of Zinc.—A chemical process for covering zinc with colored coatings has lately been described by Dr. L. Stille. The articles of zinc are first brightened by scouring with quartz sand, moistened with dilute muriatic acid, putting them quickly in water, and then carefully wiping them dry with white blotting-paper. To ensure success, however, it is necessary to employ zinc as free as possible from lead, and to have it as bright as a mirror. When these conditions are fulfilled the metal may be coated with a variety of beautiful colors by immersion in a solution of alkaline tartrate of copper for a shorter or longer interval of time, depending on the color that is desired.

Is Government Inspection of Steam-Boilers a Failure?

To the Editor of the Manufacturer and Builder:

Your journal has constantly urged upon steam-users the necessity of a thorough examination of their steam-boilers, indicating the dangers to which they were exposed, and favoring a practical examination internally and externally, as affording the greatest security against explosion.

The large number of explosions on board steam vessels in our harbor during the past few months by which many lives were sacrificed, and a considerable amount of property destroyed, has again raised the question: Is any security obtained in the government inspection of steam-boilers as conducted by the United States Board of Supervising Inspectors who use the hydrostatic test long since condemned and discarded (except as an auxiliary to inspection) by engineers in this and other countries? Condemned—because it fails to discover most of the dangers to which boilers are exposed, and it has frequently happened that disastrous explosions have occurred within a very short time after a boiler had been satisfactorily tested. The test of the "Westfield's" boiler was made only a few weeks before it exploded; yet the coroner's inquest showed that the defect that caused the explosion had existed many months, and could have been detected had an examination been made.

Chief Engineer Fletcher, of Manchester, England, submitted a report to the Select Committee of Parliament in 1870, which body was investigating the subject of steam-boiler explosions, showing that the explosions in the United Kingdom from 1861 to 1870 were due to the following causes:

40 per cent to malconstruction.
29 " " defective condition.
17 " " rupture of seams over fire.
15 " " overheating.
2 " " overpressure.

How many of the above defects would have been discovered by the hydrostatic test?

The experimental explosions at Sandy Hook, in 1870, under the direction of Prof. Thurston, further established the fact that one old boiler, after having been tested to a hydrostatic pressure of 60 pounds, exploded with great violence at a steam pressure of 53 pounds.

The recent explosions in our harbor have all been caused by defects that a proper examination could not have failed to discover. They were as follows:

Steamer "Magenta." The steam chimney had corroded away to the thickness and strength of brown paper. This boiler had been tested, and a certificate given, some seven months previously. Local Inspector Matthews, in his report of this explosion, states "that an examination of the piece torn out showed that it was not more than one-32d of an inch in thickness at the point where the rupture occurred—that the inspection was not as thorough as it might have been; yet the inspector was warranted in granting a certificate."

Tugboat "Sam Stanton." This boiler had over 2,000 square inches of surface on each side, without a brace or stay of any kind, the other parts of the same boiler being braced on areas of less than a square foot, the steam pressure allowed being 65 pounds. The rupture was of the unstayed part following the line of weakness.

Tugboat "A. G. Cattell." Explosion of a flue that had become so corroded and rotten as to give way at the ordinary working pressure.

Tugboats "E. Henderson" and "Wm. A. Sumner," and steamer "Moses Taylor" are all more recent additions to this list.

By each of the above explosions lives were lost. The boilers had all been tested within a year—in some cases within two months—and were duly certified for their work of death and destruction to those about them. In the case of the "Adelphi," the character and security of the hydrostatic test is well shown. Your readers are already familiar with the gross ignorance and carelessness as developed by the coroner's inquest. I will only call your attention to the fact of the last inspection (so called) being made while there was fire in the furnaces.

The following table, compiled from official reports, compares the work of the United States Government inspection and their system of testing with that of the Hartford Steam-Boiler Inspection and Insurance Co., who made thorough examinations inside and outside the boiler, and where defects are found they are interested in having them remedied before explosion takes place.

STATEMENT OF CASUALITIES

Resulting from the Explosion of Steam-Boilers, under the care of the United States Board of Supervising Engineers, compared with that of the Hartford Steam-Boiler Inspection and Insurance Company.

Name of Inspection.	Form of Inspection.	Number of Boilers Inspected Each Year.							Lives Lost by Explosion Each Year.							Damage to Property by Explosion Each Year.							
		1870	1871	1872	1873	1874	1875	1876	1877	1870	1871	1872	1873	1874	1875	1876	1877	1870	1871	1872	1873	1874	1875	1876	1877
U. S. Inspectors.	Hydrostatic Test.	4,498	4,780	4,993	5,427	5,698	5,809	5,702	5,868	180	230	66	10	62	27	61	31	$ 45,064	$ 216,200	$ 109,100	$ 4,100	$ 129,000	$ 26,350	$ 81,700	$ 15,000
Hartford Steam-Boiler Inspec. and Ins. Co.	Examination and Hammer Test.	2,220	3,266	6,922	7,746	8,270	8,705	9,227	9,689									2,500	1,800	16,236	10,724	8,654	18,368	10,517	5,541

SUMMARY.

United States Board of Supervising Engineers.

Total number of boilers tested	42,473
Total number of lives lost by explosion	667
Total amount of property destroyed by explosion	$623,514

Hartford Steam-Boiler Inspection and Insurance Company.

Total number of boilers examined	56,145
Total number of lives lost by explosion (12 years*)	25
Total amount of property losses	$74,381

The comparison shows conclusively the relative merits of the two kinds of inspection, and I think your readers will agree with me that the government inspection of steam-boilers is a failure. F. B. Allen.

*These twelve years represent the whole time since the organization of the Hartford Steam-Boiler Inspection and Insurance Company.

The Railroads of the World.

A French writer has been carefully collecting the railway statistics of all nations. At the close of 1869, the total railway mileage in the world was 183,982 miles, apportioned as follows:

	Miles.
Europe	89,430
America	83,420
Asia	7,689
Australia	1,924
Africa	1,519
Total	183,982

At that time the United States had but 74,095 miles of railway. But at the close of 1877 the mileage was 79,514, and must now be about 82,000. Other nations are credited as follows:

	Miles.
Great Britain	16,794
France	13,492
Germany	17,181
Russia	11,555
Austria	10,852
Italy	4,815
Turkey	830
India	6,527
Canada	4,200
Peru	960
Argentine Republic	990
Egypt	975
Brazil	836

Europe has a capital of $10,500,000,000 invested in railways, against $6,000,000,000 for America and all the rest of the world. The railways of Europe in 1876 carried 1,140,000,000 tons of freight, or about 470 passengers to every 100 tons of freight. It is estimated that 4,000,000 rails are required every year to renew the worn-out stock on the roads already in operation, besides what are needed to lay down new roads. The average wear of a rail is ten years. The rolling-mills of the United States have a capacity of nearly 2,000,000 tons, though our consumption of rails including imports, is not half that amount.

Responsibility of Architects.—The question of holding architects personally responsible for the safety of buildings erected under their supervision, is placed prominently before the public by the action of the Institute of Architects, which recently held its regular annual convention in this city. The Rhode Island Chapter of that body has framed a law which is intended to change the existing conditions by making faulty work a penal offence, punishable by fine and imprisonment. It is proposed to apply this rule to contractors, builders, and architects alike. In France architects and builders are held responsible for a building for ten years after its completion. There is no reason why such a law should not be enacted here.

Constructive Carpentry.

CONTINUED FROM PAGE 274, VOL. X.

Rules for Inclined Roofs.—If the roof to be constructed is to be placed on a rectangular building, Fig. 1, the side *a c* is divided into two equal parts in *e*; from *e* a line *e g* parallel to the base is drawn, and *e g* made equal to the half parts *a e*, *e c*; from *g* draw the oblique lines *a g* and *g c*. The same is done at the other side *b d*, and the line *f h* made equal to *f b*; *h* and *g* united give the ridge of the roof, while the lines *a g*, *g c*, etc., give the horizontal projections of the hips. If to the roof is given a slant of 45°, the actual length of the line *e g* will, according to the property of right angled triangles, be equal to $\frac{1}{2}ac \times \sqrt{2}$, and, applying the same rule to the triangle *e g c*, *g e* will be equal to $\frac{1}{2}ac \times \sqrt{2} \times \sqrt{2} = ac$.

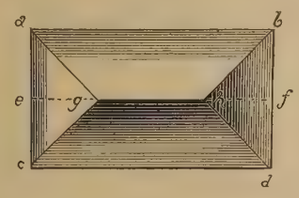


Fig. 1.

For an irregular roof it is to be divided into different parts, consisting of rectangles, parallelograms, and trapeziums. Thus, for instance, the roof for Fig. 2 is best divided in the rectangle *y b f e*, and the trapeze *y d c a*. The first is laid out as in Fig. 1. For the second figure *y d c a*, it must be remarked that at the side *a c* the line *l g* must not proceed from the middle of *a c*, but from the middle part *g* of the distance between the lines *a y* and *c d*. This line is drawn until it meets the oblique line *h y* in *h*, and so determines the side of the roof *b a g h*, which runs up higher and to a point over the rectangle *b f a y*, and is lower along the ridge on the other figure. From *h* to *d* a line is drawn which forms what is called the "valley." It will be found where the line *d h* can also be found when the angle at *d* is bisected in the usual way. The dotted line half way between the base and ridge of the small roof may be drawn as a test all around the whole; if it corresponds at all the hips and valleys, it may serve to show whether the drawing is correct or not.

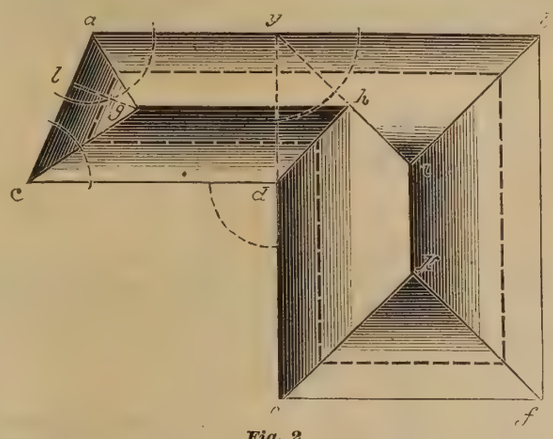


Fig. 2.

Fig. 3 shows an irregular roof, bounded by high partition walls; *a b* is the front at the street, where water may be discharged, while the water of the rest of the roof is discharged in the court *e f h g*. First the section *c a m o* is separated, and as *a c* is a high wall, the line *a c* is fixed; in order to find the other lines the angle *a m o* is bisected by *m k*. To find the ridge between *a b* and *e f*, it is drawn after the lines *k m* to *p*, and at the other side to *r*. From the point *p* to *e* the valley is formed of the planes *p r e f* and *p e c n g*. As a test the angle *e* can be bisected, or half of the width of the small roof set off in the direction *n p* from the line *m o*.

The valleys of the other three angles are found by bisection, or by drawing from *o'* to *n'* the half (here the whole) distance from *y* to *n*. In this way the roof rises from the base *a b*, from *b* to *r*, falls again to *n*, is horizontal from *d* to *n'*, from whence it rises to *c*.

Diphtheria and Kerosene Oil.

About a year ago the assertion was published that the main cause of diphtheria is due to the use of kerosene oil; that before its introduction as an illuminator this disease was unknown, and has been prevalent ever since this oil was used and its odor pervaded many dwelling-rooms, producing this destructive and terrible disease.

We never could believe this, as our personal experience among parties using kerosene did not at all verify the assertion, and chiefly because we considered petroleum and its derivatives, such as kerosene, rather as a disinfecting antidote for many contagions than as a cause of disease, petroleum refiners, who are extremely exposed to its emanations, not being at all subject to such ills.

Now comes an offset to the previous assertion, from Plattsburgh, Pa. A correspondent of the *Republican* writes that the wife of a miller by the name of Light, who lately moved there, states that some time previous she had an attack of diphtheria, and cured herself by the use of kerosene oil as a gargle, and also swallowed some; but the remedy was so simple that her neighbors thought nothing of it until five of Joseph Jelley's children were taken with diphtheria. Their throats became swollen and cankered terribly. The mother sent after a neighbor who had lately lost a son by the disease, to ascertain whether it was really diphtheria or not. The neighbor pronounced it diphtheria in a very dangerous form. Mrs. Jelley said she would try Mrs. Light's remedy—kerosene oil—which she gave her children as a gargle, and also had them swallow some. The children recovered rapidly, and in a few days were out on the street. Several other cures of the disease are mentioned by the application of this remedy.

More Nickel-Plating Law-Suits.

The patent law-suit in regard to which we published an article in our December number, becomes more complicated from the fact that in case it is decided that the patent on nickel-plating is lawful, two rival companies are ready to contest its ownership, namely, the American Nickel-Plating Company and the National Nickel-Plating Association, whose interests are in common, and the United Nickel Company. The company first named is composed of prominent and wealthy citizens of New York and Boston, who formed the American Nickel-Plating Company in 1866, purchased the Adams patent, and have subsequently acquired further interests in his invention. The other, the United Nickel Company, is also composed of prominent men of New York, and was organized about three months after, under the same patents, it is claimed, and another patent which has since been pronounced invalid.

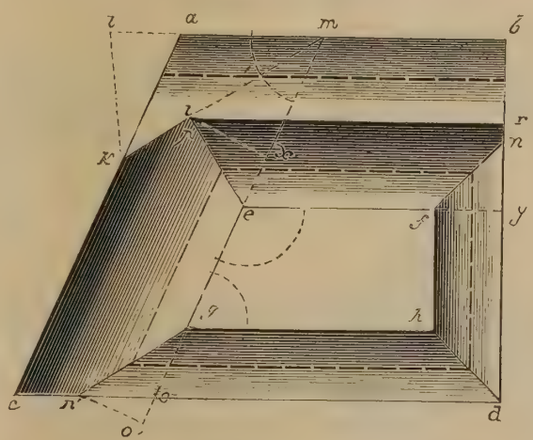


Fig. 3.

These two companies are pressing their claims with all the vigor which such vast prospective revenues to the winning party naturally would call forth. A test case was argued at the late term of the United States Circuit Court, Judge Lowell presiding, the Hon. E. N. Dickerson presenting the case for the United Nickel Company, and Gen. Butler for the American and the National companies. The case lasted through two days, and was listened to with much attention by the numerous interested parties.

The decision will be awaited with great interest by the parties to the controversy and those carrying on the nickel-plating business. This suit is of great importance, especially to nickel-platers, as in case the patents are sustained, the question arises: To whom shall they pay royalties? Paying to the losing party, they are liable to pay over again to the one gaining the suit.

The American and the National companies have already published a caution to those liable to be interested, against paying for licenses or back royalties to any company but themselves. We may expect a counter caution from the United Company, but hope and trust that a simple decision that the patents are invalid will end the matter, which thus far has only been profitable to the lawyers employed.

Economical Use of Gas.

The *American Manufacturer* says: "In the course of a lecture on electric light by Prof. Barker in Philadelphia, which he illustrated by some experiments, a Schleicher gas-engine was used to drive a magneto-electric machine. It is stated that the engine did its work well, and its operation was peculiarly interesting from the fact that the gas used to drive the engine was the ordinary illuminating gas. Of this there was consumed in driving the engine about what would be consumed by four 5-foot burners—say a quantity of gas that would give light equivalent to that which would be emitted from 80 to 100 sperm candles; but this quantity of gas, after being first turned into power, the power being next turned into electricity, and the electricity then turned into light, emitted light equal to that of about a thousand candles. The gas, by these transformations, was made to yield an electric light about ten times its own light-giving power."

The above-mentioned paper adds that if this is correct, and verified by further experiments, it will accomplish a revolution in the use of electric light which will not conflict with the interest of gas manufacturers. We add that this very process has been in use in London for the last two years by the son of the editor of this journal—Mr. Henry Van Der Weyde—for the purpose of making photographic portraits at night, and has proved a great success. A hundred times the amount of gas consumed in the engine would not be able to furnish light enough to make a photographic picture. This fact settles the matter beyond the shadow of a doubt that with the assistance of such machinery much more light can be got out of common street gas than by simply burning it in the usual way.

Ringing Engine-Bells by Steam.—There are about half a dozen engine-bells on the line of the Pennsylvania railroad that are rung by steam. An iron rod is run from the bell to the boiler, and is turned on the same principle as the air-pump, when it is necessary that the bell should be rung, and the steam works the rod to and fro.

Defective Designs of Steam-Boilers.

A very instructive lesson may be derived from the following description of a boiler that exploded last year, the remains of which were examined by an expert of the Hartford Steam-Boiler Inspection and Insurance Company. As a government inspector had called it the best boiler in his district, and as the examination of the remains proved that the cause of the calamity was nothing but weakness from a faulty construction, we concluded that it would be very useful to lay before our readers the adjoined illustrations, for which we are indebted to the inspection and insurance company referred to.

It will be seen that this boiler, notwithstanding its assumed strength, contained within itself, in the form of injudiciously applied braces and stays, the very elements that caused its destruction. Fig. 1 represents the top of the boiler; the man-hole is seen at the right, the smoke-hole at the left, and the steam-dome in the center. The shell had been cut away for the man-hole and dome 40 inches in 78, and reinforced by a slight cast-iron frame and by eight stays or braces from the dome-cover to a yielding portion of the shell, that portion within the dome being in equilibrium of pressure. In addition to these supports six braces were connected to the shell and the back smoke-box. Fig. 2 is a side view of the same, and Fig. 3 shows the interior in perspective, Fig. 4 is a longitudinal section of the boiler, showing the bracing of the dome to the unsupported portions of the shell. Other bracing is also shown, and the line of fracture on the left side. These braces, which are $\frac{1}{2} \times 4\frac{3}{4}$ inches in section, are nicely fitted, having round bolts fitting snugly into round holes in the arched double stirrups which stand upon an unyielding part of the crown of the smoke-box; the other ends of the braces are similarly fitted to double-angle plates on the shell. Now, glancing at Fig. 5, imagine this smoke-box to be an expanding body relatively to the shell—that is, imagine it to be a little hotter than the shell, (and why may it not be considerably so, filled at times with intensely heated gases, and surrounded by water at 331°, which is the temperature at which it boils under 90 pounds pressure above the atmosphere, while the shell, unprotected as it was from the cold atmosphere, say at times as low as 60° outside and 331° inside?) and who can estimate the force that is added to the 90 pounds internal pressure? But the shell was not entirely rigid and unyielding, the space above the back smoke-box must be flattened by the radial thrust of all the stays and braces around the smoke-box, which would bend the flange of the back head inward. The cracks that were caused by this action were plainly distinguishable from the fresh rupture, as was a crack or old fracture in the man-hole frame. Two years' action proved quite sufficient to bring it to destruction; a considerable length of weakened plate gave way like opening a door, and the contents of the boiler (water surcharged with steam) and steam expanded in so sudden a manner as to tear all before it.

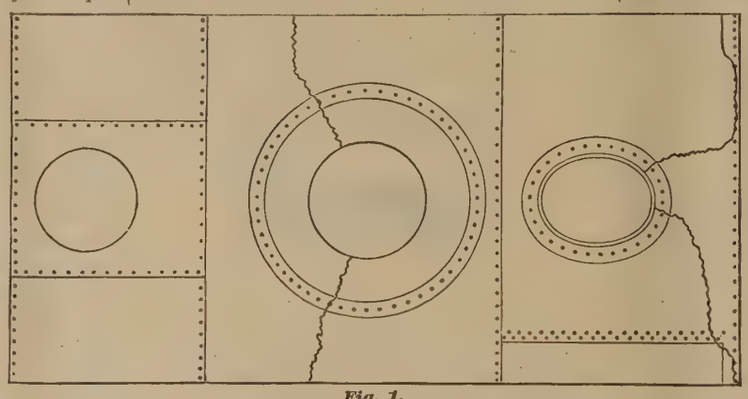


Fig. 1.

There was extensive internal corrosion at the point where the barrel joins the box, and in other places on the lower parts of the shell. We can hardly escape the conviction that the lower part of the shell, where the water is cooler from defective circulation, was kept in an unhealthy state of tension by the thrust of the hotter and very rigid flues above. On examining a sketch of Fig. 6, it could not, however, be determined that the initial point of rupture was in the lower part of the boiler, or otherwise the boiler would have gone high in the air, as the dome and smoke-stack did. There was very little scale, incrustation, or deposit, and no burned plates or other evidence of lack of water. Fig. 6 represents the principal part of the shell which was torn off and thrown some distance into the water. Fig. 7 shows what remained of the boiler after the explosion.

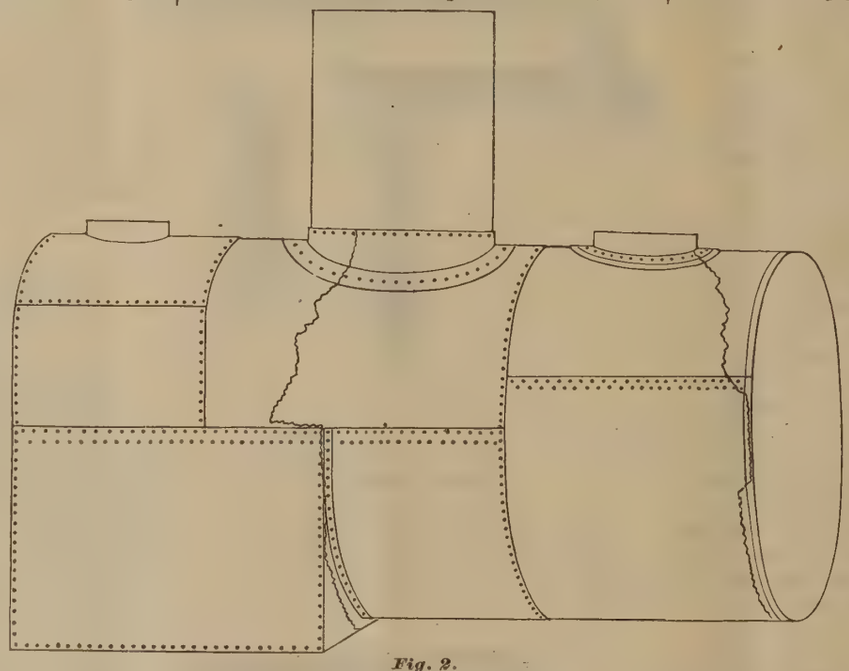


Fig. 2.

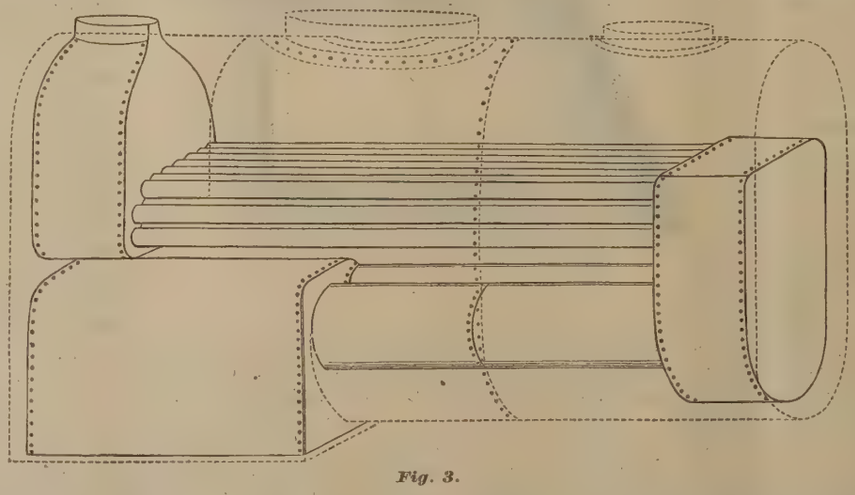


Fig. 3.

Treatment of Bessemer by the English Government.

It has been said that republics are ungrateful, but the treatment of Mr. Bessemer (the inventor of the steel, or rather cast wrought-iron, named after him, "Bessemer metal") by the English government is an illustration showing that royal governments may, and do, act as unfair as corporations, which, as the saying is, have no souls.

Mr. Bessemer in his younger days was as fertile in invention as is Mr. Edison, though not in the same field. At the age of twenty, which was forty-five years ago, he discovered a process by which he could make a permanent die, even from a thin paper original, capable of producing a thousand copies of an embossed stamp such as is used by the government and in legal transactions. By this process the most valuable stamps could be counterfeited in ten minutes, at the cost of a few cents, and by the merest tyro, in such a manner as to utterly defy detection. The public knowledge of such a means of forging would, at that time, have utterly shattered the whole system of the British Stamp Office. Alarmed at the possible consequences of his discovery, he abandoned further experiments in that direction and buried the secret of the process in his own breast, where it has ever since remained.

His next step was to find some process by which frauds on the government could be prevented instead of facilitated. Having learned that the ordinary embossed stamp then in use for large transactions, could, by a little ingenuity, be transferred from old documents to new ones, and thus be made to do duty several times, and that the annual loss to the government in this way probably equalled half a million dollars, Mr. Bessemer set himself to work to provide a stamp that could not be obliterated by damp, as would be the case with an embossed stamp on the parchment itself, or removed, as was done with stamps impressed on paper attached to the parchment. After months of patient labor, necessarily carried on in secret after his regular daily duties were performed, he invented a die which perforated the parchment with more than 400 holes in the shape of a design with the necessary words, surrounded by delicate lace-work. When this was completed, he presented himself to the chief of the Stamp Department, explained the process by which the stamps in use could be easily counterfeited, and exhibited the device to prevent existing and possible frauds. The official was astounded at the magnitude of the peril in

which the stamp system stood, and delighted with the device for its safety. Arrangements were made by which the government was to become exclusive owner of the device, and Bessemer was to be rewarded by a position in the office worth from $3,000 to $4,000 a year.

The young inventor was overjoyed at his good fortune, and for a good reason. He was engaged to the present Mrs. Bessemer, but the young pair were not exactly in a pecuniary condition to wed. The promised position made the way clear, and Bessemer hastened to inform his betrothed of the bright future before them, and to explain the invention that had made their happiness complete. She was a clear-headed young woman, fit to be the wife of an inventor. After listening to his explanation of the device and the frauds that it prevented, she said: "Yes, I understand this; but surely, if all stamps had a date put upon them, they could not at a future time be used again without detection." In an instant Bessemer saw that his elaborate device for perforating dies was unnecessary, and that his labor of months had been wasted. Procuring one of the dies in common use, he drilled holes for the insertion of movable steel type engraved with the day, month, and year, and this simple contrivance dispensed with the necessity of manufacturing new and costly dies. If Bessemer had been a shrewd schemer, he would have told his last discovery to no one. But he was a simple-minded inventor, and at once hurried off to the Stamp Office with his news. The government official saw the advantage of the change and immediately adopted it. Bessemer ventured to hint about his promised place, but was told the position was no longer necessary. To requests for compensation in some other form the government official returned a cold stare, and all subsequent officials have repeated the stare whenever approached upon the subject. For forty-five years the British Stamp Office has used Mr. and Mrs. Bessemer's invention to the saving of least half a million dollars yearly, upon its own confession, and they have never received one penny in recognition of their services. Nor is that all. When the late emperor Napoleon offered to invest Mr. Bessemer with the Grand Cross of the Legion of Honor in recognition of his services to mankind in the discovery of his process of making steel, on condition the British government would permit him to wear it, it promptly and peremptorily refused the permission, and the order was not conferred.

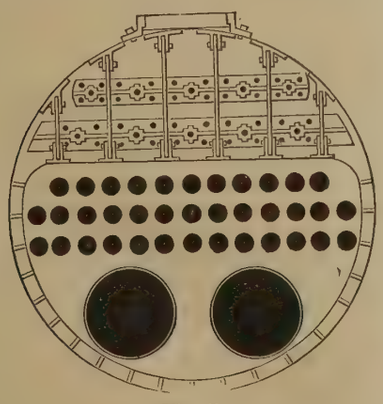


Fig. 5.

BRICK-MAKING BY STEAM.—According to the *Iron Age*, there are two brick-yards in this country—one at Washington and the other at Baltimore—with machinery for making bricks by steam, which is stated to be very rapid and economical in operation. Each of these establishments is said to have a capacity of over 200,000 bricks per day. The clay, after it has been passed through iron rolls, which pulverize the small stones and reject the large ones, is carried to the top of the building and then falls into the disintegrator, which feeds a wheel furnished with molds, which, in the two revolutions it makes each minute, turn out 232 bricks. As the wheel revolves the bricks drop on to an endless belt which carries them to a shed some 50 feet away, where they are loaded by hand upon small cars, which are rolled into drying ovens and allowed to dry for about five hours, the dampness in these ovens being constantly withdrawn by an exhaust fan. After this they are stacked in kilns and dried.

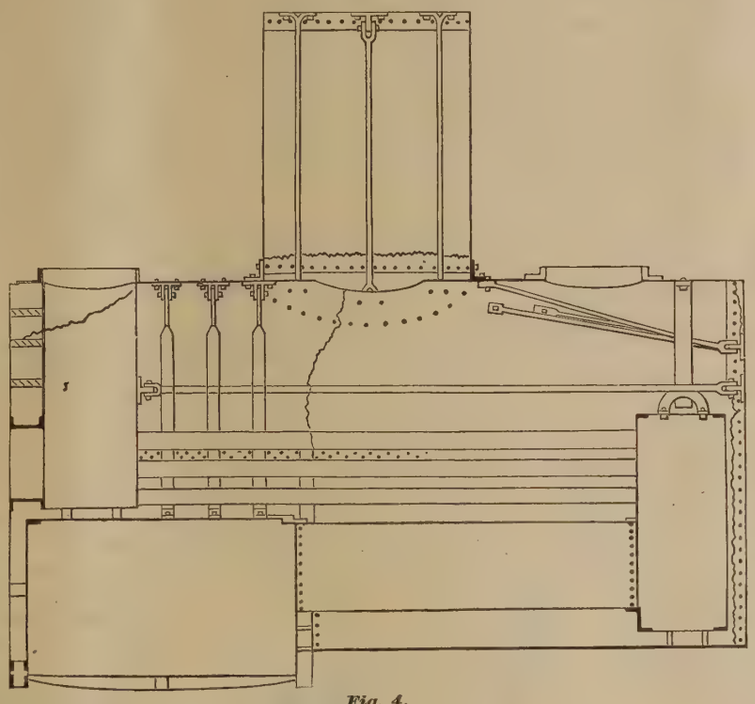


Fig. 4.

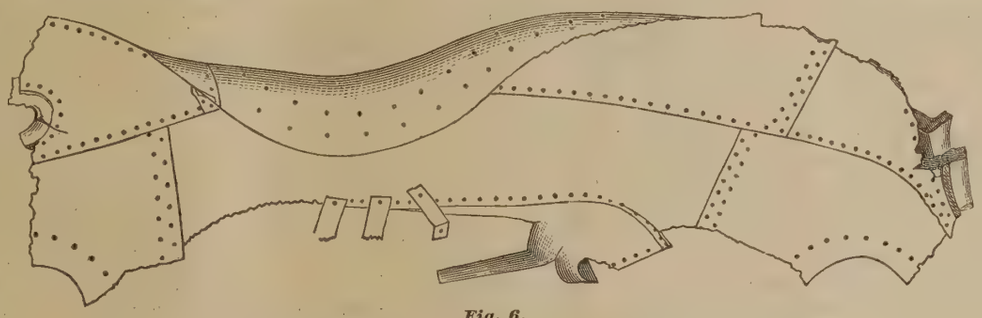


Fig. 6.

Important Improvement in Reeling Silk.

The first operation gone through to obtain the silk from cocoons is to put them into hot water, by which the gummy substance sticking the threads together is softened, and the threads that form around the chrysalis a kind of felting, may be unwound. This whole covering, which is about one-eighth of an inch thick, consists of only one single filament; this the silk-worm spins around himself while preparing for his transformation, and the difficulty thus far experienced is the tedious hand-labor and continual watchfulness required therefore. From five to seven of these filaments are joined to make up a larger thread. Heretofore this has always been done by hand. Steam was sometimes used to draw these threads, but the difficulty was that the machinery could not be stopped quick enough when one of the filaments parted, and for this reason the thread formed by the joining of several filaments is likely to be far from uniform in thickness.

Mr. Edward Serrell, Jr., a well-known New York engineer, who became much interested in silk culture two years ago, fancied that the problem might be solved with delicate electrical machinery. He visited the Paterson (N. J.) silk factories, and others, and after making many designs, finally invented an automatic machine which he believes will fill the required conditions. This machine is a great improvement upon the French, Italian, and Chinese reels. It has an electric stop motion, by which, while several reels are run at a time by an operative, they in

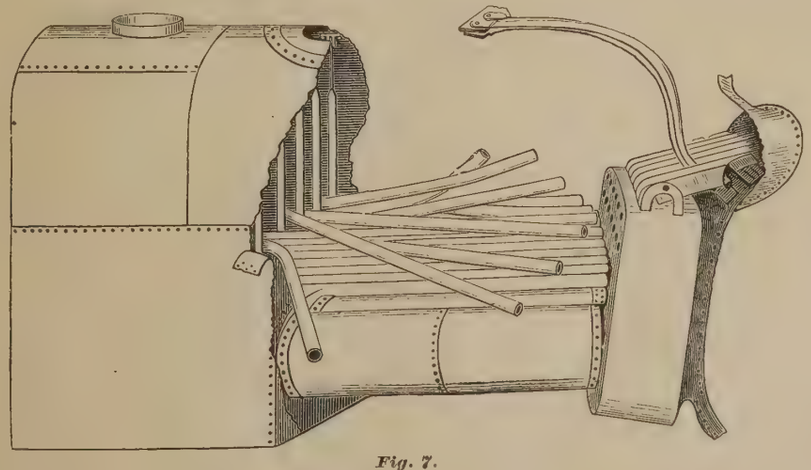


Fig. 7.

makes 450 revolutions per minute. Here it is reduced to a fine powder and passes off into a pipe, where, by the addition of steam, it is moistened enough to give to its particles the proper cohesiveness. This pipe

effect watch themselves, or rather, the electricity watches much more sharply than could the most experienced operative, and if the thread or any single filament suddenly parts, the reel as suddenly stops and

the filament is united. The little contrivance over which each filament runs is about an inch in hight, and is deliberately poised upon a rivet that runs through it, and sustained by standards. When the filament is running steadily across it, it is stationary, but if the filament breaks its two little arms fall into a gutter filled with mercury, connecting with the battery. This at once stops the reel and rings a bell to call the attention of the operative to the fact that one of the threads has parted and should be reunited; he then repairs the break and starts the reel again. By this means an ordinary operative may easily reel from thirty to forty pounds of silk in a week with certainty and despatch.

The silk industry of this country is valued at $25,000,000, and the whole silk product at upwards of $50,000,000. The cocoons are raised here, sent abroad to be reeled, and then brought back in the form of twists to be manufactured, as that kind of hand-labor is so expensive here that the difference of its cost with that of hand-labor abroad surpasses the cost of double transportation across the ocean. In fact, reeling silk from the cocoon has never been profitably done in this country. In France the operatives earn on an average one franc, or twenty cents a day. In China and India the remuneration is still smaller. In no part of the world, however, does the silk-worm thrive better than in this country. The mulberry tree, upon whose foliage it fattens, flourishes in our soil. In fact, at the present time hundreds of thousands of dollars worth of the eggs alone are exported from California, Kansas, Missouri, Louisiana, and other States to Europe and Asia, because of their superior quality.

If this new invention proves a success, Mr. Serrell deserves the gratitude of this country for having promoted the interest of one of the most profitable industries of the world.

Progress of Electric Illumination.

It is reported that the New York *Times* is about to introduce the electric light in its composing-room. The cost of the gas used there is about $500 a month at present. The cost of the electric light, it is claimed, will be only $100 a month, after the first cost—$1,000—of fitting up the apparatus. This will be one of the test applications of the light, and upon its success will depend a good many interesting questions, of which one is perhaps the prosperity of gas companies, as parties now having the use of steam-power will not need any gas; but even those having no steam-power may use gas only to drive a gas-engine, as mentioned in another article in this number, and thus obtain much more light with a reduced amount of gas, an economy which will also diminish the consumption and so react unfavorably on the gas companies.

In regard to the extending use of the electric light in Europe, fresh and favorable reports are continually arriving. Thus we read with regard to the illumination of the office of the London *Times*, that it appears like a flood of daylight, which is produced by six small lamps placed at intervals around a large room, in which compositors and others are busy at work. These lamps are suspended so that they can be raised and lowered at will. In compliance with the wish of some parties who were inspecting the light, one of the lights, selected at haphazard, was turned out, and it remained out without the slightest perceptible increase in the volume of light in the other lamps. Then another light at a distance was treated in a similar manner and with a like result. These two were then relit by a turn of the tap the reverse way and turned on full power. Then one was slightly lowered so as to give about a third of its full light, as with ordinary gas.

In short, it was found an agreeable light, which can be moderated and arranged to suit circumstances. This is called the Rapieff light, and it seems to possess great simplicity. M. Rapieff says he can burn ten lights in the circuit; that his carbons will burn ten hours; that they can be easily renewed, and without extinguishing the lights. He estimates its comparative cost with gas as being less than a third; but such statements must be taken for what they may be worth.

Microscopic Measurements.

When the focal length of all the lenses of which a microscope is composed, is known, it is not difficult to calculate its magnifying power according to the rules of optical science; but as the focal lengths referred to have to be determined by tests, it is much easier and more certain in its results to measure this magnifying power directly by observation. Several methods may serve this purpose.

One method is that of Jacquin; he places a micrometer (that is, a very fine scale engraved on glass, and of which the division lines are about the one-100th part of an inch or less apart) on the stage. However, he does not look directly down the tube, but uses over the eye-piece a small reflector, as shown in our adjoined figure, placed under an angle of 45°; into this he looks from *o* in a horizontal direction, and so sees the image of the enlarged micrometer vertically against the wall, as shown in our figure at the left. Next to the image an actual measure in inches may be suspended at the same distance from the eye as corresponds with the apparent distance of the image. A direct comparison will then show the power; if, for instance, the 100ths

of inches of the magnified micrometer correspond in size with half an inch, the micrometer magnifies fifty times; if they correspond with inches, the instrument magnifies one hundred times, etc.

Another method which we usually apply, and which requires no reflector, but some practice to accomplish successfully, is to place next to the microscope a measure upon the table, and to look down with one eye into the instrument to see the magnified micrometer, and to look with the other eye upon the measure, and by shifting the latter to make its lines apparently cover the lines of the micrometer, when a direct comparison will also show the magnifying power.

Another way, which requires neither reflector nor micrometer, is to fix to the stage a nut in which a long fine screw fits, of which the number of threads to the inch is known—let there be say 50 threads to the inch; it will be clear that one revolution of the screw will advance it one-50th part of an inch; half a revolution, one-100th part; and a quarter revolution one-200th part. In order to regulate these quarters, and even eighths, or less parts of a revolution, the head of the screw may be marked by a projecting point, or even graduated when still lesser parts, such as thousandth parts of an inch may be indicated. If now the point of this screw is made to move any object seen in the field of the instrument forward, the amount of its motion may be compared with a measure lying next to the microscope on the table. For instance, let a quarter revolution of a screw of 50 threads to the inch advance an object apparent $\frac{3}{4}$ of an inch; it is evident that if an actual motion of $\frac{1}{4}$ of one-50th or one-200th part of an inch becomes magnified to $1\frac{1}{2}$ inches, the magnifying power must be $1\frac{1}{2} \times 200$, or 300 times.

This contrivance is not only useful to determine the magnifying power of a microscope, but is still better adapted for the direct measurement of objects under observation, because as for every half revolution of such a screw, the object pushed forward by it will advance one-100th part of an inch, it is, in order to determine the distance of two points, only necessary to bring, by turning the screw, the second point at the same place previously occupied by the first, when the revolutions, and parts of revolution of the screw, will give the distance in 50th parts of inches.

Such a screw, simple as it may be made, is in fact a micrometer screw, and we have two of them attached to the movable stage of one of our plainest microscopes, one pushing the stage forward, the other sideward, and both giving, for every half revolution of the screw, a motion of the one-100th part of an inch. We can, by using quarter and eighth revolutions, easily in this way directly determine dimensions of one-200ths and one-400ths of an inch, and by estimation by the eye 800ths and less, and we recommend this arrangement to all microscopists who cannot afford to buy expensive micrometers.

Scientific.

The Asserted Transmutation of Metals.—In regard to Norman Lockyer's reported discovery, the London *Daily News* says that he has realized the alchemist's dream—the transmutation of metals. In the presence of a small party of scientific men, Mr. Lockyer, by the aid of a powerful voltaic current, volatilized copper within a glass tube, dissolved the deposit formed within the tube in hydrochloric acid, and then showed, by means of the spectroscope, that the solution no longer contained copper, but another metal—calcium, the base of ordinary lime. The experiment was repeated with other metals and with corresponding results. Nickel was thus changed into cobalt, and calcium into strontium. The *Daily News* further remarks that all these bodies have ever been regarded as elementary—that is, as capable of being resolved into any components, or of being changed one into another, and that it is on this basis that all modern chemistry is founded, and that should Mr. Lockyer's discovery bear the test of further trial, our entire system of chemistry will require revision.

We have already expressed our opinion in regard to this in our December number (page 271), and consider that it would only be an addition to the science of chemistry if we learned to decompose a substance which thus far we have called elementary, because we were not acquainted with the means to decompose it. It may be a discovery similar to that made in the beginning of this century, when ammonia was considered to be elementary, while it was found to consist of nitrogen and hydrogen; when muriatic acid was believed to be a compound of the element muriam with oxygen, while it was afterward found that it consisted of chlorin and hydrogen, and hence had its name changed to hydrochloric acid.

The *Daily News* further says that it is difficult to limit the future possibilities of the discovery; that the great object of the old alchemists was, of course, to transmute base metals into gold, and so far as our knowledge goes, there is no reason why copper should not be changed into gold as well as into calcium. The means at present employed are obviously such as to render the process far more costly than any possible results can be worth; but this is necessarily the case with most scientific discoveries before they are turned into commercial facts. Mr. Lockyer is one of our best living spectroscopists, and no man with a reputation such as his would risk the publication of so startling a fact as he has just announced to the scientific world, without the very surest grounds. He is known by his friends as somewhat sanguine, and he does not pretend to be an accomplished chemist, but during his experiments he was supported by some of our leading chemists, all of whom admitted that the results of his experiments were inexplicable on any other grounds but those admitting of the change of one element into another, unless indeed our whole system of spectrum analysis is to be upset, the other horn of a very awkward dilemma. Since Priestley (a hundred years ago) discovered oxygen and founded modern chemistry, there could be no discovery made which would have such an effect on modern science as that the so-called elements were no longer to be considered elementary

So much for the English paper referred to. It strikes us that the mere fact of the similarity of the spectroscopic lines seen in the spectrum of calcium with those of the copper which he submitted to the treatment described, is by no means a complete proof that the copper was changed into calcium, especially as it is already well known that the spectroscopic lines are variable for the same substance and change with the temperature to which the substance under observation is submitted while making the experiment, and that the absorption bands seen in solutions of various substances are entirely independent and different from the lines seen in the flames of the same substances. For a full proof of the reality of the transformation it is necessary to submit the substance obtained to a chemical test. This test for distinguishing copper from calcium compounds is simple enough; oxalate of ammonia gives with the latter a white precipitate of oxalate of lime, while with copper solutions it gives no precipitate, but causes the solutions to become blue or dark green.

As the spectroscope is a comparatively new instrument, about which we have yet to learn a great deal, its indications are by no means a positive proof that a real transformation has taken place of such a nature as that stated, and which is quite improbable. It is much more likely that it is due to a peculiar behavior of the spectroscope, of which thus far we had not the knowledge; and in so far we consider the discovery of importance, even if it does not lead to the sanguine conclusions of Mr. Lockyer and his friends.

Evolution and Spontaneous Generation.—Rev. W. H. Dalinger, who is well known through his combat against the theory of spontaneous generation, lately delivered a lecture in London on the relations between his theory and that of the evolutionists. According to the report in *Iron*, there were, he said, many admirers of the theory of evolution who held that unless spontaneous generation were admitted, the theory was incomplete. Just as in water there is the potentiality of forming crystalline patterns in snow and ice, so they hold that in organic matter generally there is potentiality of forming protoplasm. No living structure contains any known element that is not met with in the inorganic world, and the only chemical difference known is the combination of the elements. But the lecturer urged that evolution and spontaneous generation were two distinct questions that need very accurate study apart. The developmental progression of all living forms from simple protoplasm is a very different question from whether living protoplasm can be spontaneously evolved from the inorganic world. For himself, if facts were brought forward to support spontaneous generation, he should be bound, were they valid facts, to accept the theory. He had, however, devoted much labor and the time of years to the rigid investigation of some of the facts that bear upon the question, and these he would describe. It had seemed to him, in studying what had been written, that there were two lines of work that needed following out very closely. One was a series of thermal experiments, to determine with exactness what is the "death point" of an organism, or a "germ." The other was to watch the life history of some forms of monads and see if they did reproduce. It was this second line he had taken up. The most carefully conducted experiments of the first groups have led to the conclusion that if all germs are excluded from septic liquids no life appears, while his experiments had conclusively shown that monads do reproduce from parental products, and the life history of successive generations had been watched. The natural inference seems to be that monads originate only from previously existing monads, and if this is true of them it is not improbable that observations conducted with equal care will show the same with regard to bacteria.

Use of the Electric Light in Mines.—The London *Mining Journal* points out that, aside from its other advantages, the success of the electric light would solve a most important problem affecting the lives of many persons now working in mines. "There appears to be no reason," says that paper, "why electricity should not be made applicable for lighting mines instead of lamps, and this would effect what our mining engineers and foremost chemists have long been looking for. It would give the men a light such as they have never dreamt of, enabling them to get a much larger quantity of coal in a given time than it is possible for them to bring down by the light of the lamp, which barely suffices to make the blackness of the working places visible." It would also benefit both masters and men, as more safety would be secured against the giving way of props and the falling in of roofs, for the reason that the men could see so much better the black surrounding walls than they possibly can by the light of their dim oil lamps; while in regard to explosions they would become simply impossible, as the electric light needs no access of air, but may be enclosed in hermetically closed glass globes, making the safety-lamp precautions, with their unreliable wire gauze, utterly unnecessary.

Coating Metals with Tin.—The process of coating metals with tin promises to extend its used for culinary and other uses. Its electro-deposition is proposed by means of a zinc and carbon battery. The inner cell containing the zinc is filled with dilute sulphuric acid. The articles to be coated with tin are put into a bath composed of 8 parts of protochlorid of tin, 16 of cream of tartar, and 2 of the chlorid if the latter is used. When it is present the tin coating is effected more rapidly, whereas, when the bath is composed of protochlorid of tin and cream of tartar only, the tin coating is very white, but is not produced so rapidly as when the chlorid is used. These ingredients should be dissolved in about 100 gallons of distilled water. The black plates are first "pickled" in any suitable manner, and then immersed in the above-described bath or solution, and are allowed to remain in the same for a longer or shorter time, according to the thickness of the deposit or coating of tin required on the plates. While in this bath the plates or other pieces to be coated are connected by a wire with the positive end of the battery, while the negative end of the battery is connected with a piece of tin hung in the same bath. When the plates or other pieces or articles have been sufficiently coated with tin, they are held over a fire in order to give the tin a lustrous appearance.

The Alums.

Common alum is the source of all the various compounds of alumina; it is a double salt, that is, a salt with two bases—alumina and potassa, and one acid sulphuric. It is made in immense quantities, so as to supply the large demand for it, which comes chiefly from dyers and those who prepare skins and furs. It is also used for the preparation of lakes, as the alumina in it possesses the property of absorbing colors, and then preserving the coloring principle in dye-woods, etc., in the solid state. It is an adstringent substance, of a slightly sweetish taste, and in medicine is used as a mouth wash for sore gums, and when made anhydrous by burning the water of crystallization out of it, it becomes a mild caustic. It also has antiseptic properties.

It is made from a salty clay mixed with bisulphid of iron, (pyrites), which clay is very abundant in some places. This clay is roasted, afterward exposed to the air, and kept moist; it absorbs oxygen, changing the sulphur into sulphuric acid, which combines with the iron and alumina, forming sulphates of iron and of alumina, which are washed out with water. This watery solution is concentrated by evaporation, and chlorid of potassium dissolved in it; this will decompose the sulphate of iron, forming sulphate of potash and chlorid of iron. The sulphate of potash combines with the sulphate of alumina to form alum, which is easily crystallized out, while the chlorid of iron is so very soluble in water that it remains behind in the solution. There are, however, other ways to make alum, which are followed when the circumstances—namely, the nature of the raw material from which it is made—are different.

Alum has a strong tendency to crystallize, and does so in the form of regular octahedrons. Advantage is taken of this for ornamental purposes; ladies sometimes make hanging baskets of wire and suspend them in a strong and hot solution of alum; when left to cool the alum crystallizes around the wires, concealing them with a kind of frosted covering, consisting of large or small crystals of a very beautiful appearance, and which may be obtained in any color by mixing in the solution some anilin coloring material, or its equivalent. For the use of alum to make a pyrophorus, see reply to Query 2269 in this number.

One of the most scientifically interesting features of alum is that some of its constituents may be exchanged for others, and so another kind of alum formed; thus we may, in place of the potassa, have any other member of the potassium group, and even of the compound ammonia, so that in this way we may have:

Soda Alum, Sulphate of Alumina, and Soda—formula: Al_2O_3, $3SO_3+NaO$, SO_3+24H_2O.

Lithium Alum.—Sulphate of Alumina, and Lithia—formula: Al_2O_3, $3SO_3+LiS\ SO_3$.

Caesium Alum.—Sulphate of Alumina and Caesia—formula: Al_2O_3, $3SO_3+CaeO$, SO_3.

Ammonium Alum.—Sulphate of Alum and Ammonia—formula: Al_2O_3, $3SO_3+(NH_3)O$, SO_3.

A rubidium alum, and a thallium alum, have also been investigated, and even a silver alum has been made by heating proportions equal to the chemical equivalents of sulphate of alumina and of silver.

But it is not only for the potash of alum that another substance may be substituted; also the alumina, the main constituent of the compound, may be displaced by another substance, provided it has the same property as the alumina to form a sesquioxid—that is, an oxid in which two atoms of the metal are combined with three of oxygen. Such substances are iron, manganese, and chromium, which respectively can be made to oxidize as Fe_2O_3, Mn_2O_3, and Cr_2O_3.

Iron Alum.—Sulphate of Iron and Potash—formula: Fe_2O_3, $3SO_3+KO$, SO_3.

Manganese Alum.—Sulphate of Manganese and Potash—formula: Mn_2O_3, $3SO_3+KO$, SO_3.

Chromium Alum.—Sulphate of Chromium and Potash—formula: Cr_2O_3, $3SO_3+KO$, SO_3.

It will be seen that these compounds last mentioned contain no alumina at all, but they are still called alums, as they have a perfectly similar composition, are what is called isomorphous, and crystallize in the same form, which is that of a regular octahedron, or body with eight faces, each of which are equilateral triangles.

Any of the latter three alums (being those of iron, manganese, and chromium) may be changed by displacing the potash by any of the elements of the potassium group, which gives for each seven more alums. Thus we have an iron sodium, an iron ammonium, alum, etc., a manganese potash, a manganese lithia, a chrome potassa alum, etc. In all there must be at least 8×4, or 32 alums.

The last-mentioned chrome potassa alum, simply called chrome alum, is a product of those galvanic carbon batteries in which bichromate of potash and sulphuric acid is used. In these kind of batteries the zinc (Zn) is oxidized at the expense of the oxygen in the chromic acid, the 2 (CrO_3) being changed, not into $(Cr_2O_2)+O_4$ or $(Cr_2O_4)+O_2$, but 2 (CrO_3) is changed into $Cr_2O_3+O_3$, as the chromium has a strong tendency to become a sesquioxid. The reaction may be represented in formulas thus:

$$\underset{\text{Metallic Zinc.}}{3Zn} + \underset{\text{Bichromate of Potash.}}{2(KO, CrO_3)} + \underset{\text{Sulphuric Acid.}}{5SO_3}.$$

$$\underset{\text{Oxid of Zinc.}}{3(ZnO)} + \underbrace{Cr_2O_3, 3SO_3+KO, SO_3}_{\text{Chrome Alum.}} + \underbrace{KO, SO_3}_{\text{Sulphate of Potash.}}.$$

Improvement in Plows.

It is strange indeed that the plow, an implement so important in agriculture that it has become the symbol of that art, has remained so long in an imperfect condition. The reasons are twofold; no class of men are more conservative and less inclined to see the want of improvements in adopted methods than farmers, while the inventor's attention was never called to improvements in agricultural appliances until within the last twenty years, since which time American inventions in that line have startled the whole world. Still the plow remained backward, and it is very fortunate that at length Mr. Oliver, who, twenty years ago, began to manufacture plows in South Bend, Ind., was the first to make the most important improvement, namely, a mold-board of chilled cast-iron. He understood that the great want of the farmers in our hard Western soils is a mold-board of hard metal, and that the use of steel made the plows too expensive, hence his attempts to produce such mold-boards cheaply. After many experiments, the trial of discouraging opinions, and the loss of friends who called him a lunatic, he succeeded in making cheap mold-boards of an exceedingly hard and tenacious material, by using Lake Superior iron in connection with Salisbury ore, and chilling during the process of casting. At the same time it was found necessary to provide ventilating grooves in the chill face by which the gases could escape, so as to preserve the casting against blow-holes being formed during the chill. Through these two inventions he succeeded in making chilled plows, and much more cheaply than if he used cast-steel; the result is that their universal introduction is only a matter of time, and this time comparatively short. The first plow of this kind was brought out in 1870, and since that time other improvements have been made, covered by eighteen different patents. Mr. Oliver now employs over 400 men, makes 75,000 plows a year, while the number has been increasing 10,000 yearly for the last three years. Some 300,000 of these plows are already in use among the farmers in the United States.

The works are undoubtedly the largest plow works in the world; they occupy 32 acres, covered by various buildings and railroads in all directions which connect them with the Lake Shore & Michigan and the Chicago & Huron Railroads. The store and shipping house is 900 feet long, exclusive of the immense lumber sheds; the foundry is 360 feet long and 165 wide; the grinding-shop, polishing-shop, wood-shop, and paint-shop, 200 by 50 feet each; the blacksmith-shop and the machine-shop, 120 by 60 feet each. The engine is of 600 horse-power, and is situated in a separate house, as are also the safety sectional boilers. The office and all the buildings are substantially built of brick, containing a floor room of 200,000 square feet, equal to a building of 40 feet wide and 1 mile long. These buildings are the result of a growth of only the last seven years, when a few men and a small water-wheel constituted the whole concern. It was thought good work if they made five plows a day; now they have facilities for turning out as many hundred, and at present actually turn out 250 a day on an average, which number is steadily increasing.

So much for the establishment; now a few words in regard to the plows produced there.

Fig. 1 represents the form of what is called Nos. 10–0, 20, and 40. No. 10–0 is a one-horse plow, and a general favorite where plows of that size are used. It is full chilled and has all the features of the larger plows, and gives perfect satisfaction in any soil. It will turn a furrow 5½ by 11 inches. No. 20 is a two-horse plow, with all the improvements. It is adapted to light, loose, alluvial or mucky soils, where boldness of turn is necessary to do good work, and will turn a furrow 7 by 13 inches. No. 40 is a two or three horse plow, full chilled, and with all the other improvements. Its great capacity, steady running and turning qualities, make it valuable in sandy or alluvial land, and on farms containing a variety of soils, while on hilly land it is unrivalled. It is claimed that no plow in the market will equal it in throwing a furrow up hill. It will turn a furrow 9 by 15 inches. In addition to the above, this company makes many other other styles of plows of Oliver chilled metal. Fig. 2 represents what is called

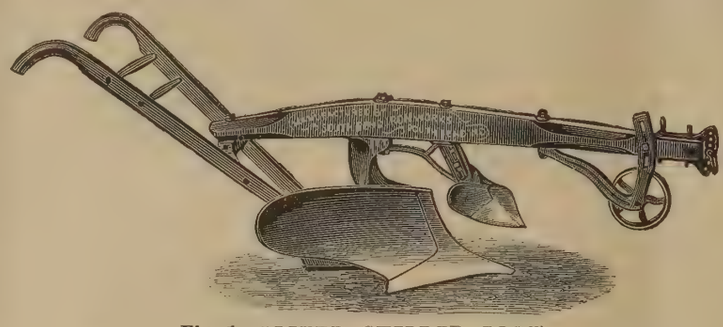


Fig. 1.—OLIVER CHILLED PLOW.

the Casaday Sulky Plow, a new implement, which is now introduced for the first time for the consideration of farmers. Its most valuable features are:

1st. It has no land-side, that heretofore indispensable part being done away with, and an inclined wheel that runs in the bottom of the previous furrow, is made to perform the duties of the discarded piece, with an astonishing decrease in draft. Experiment has demonstrated that 50 per cent of the turning draft of a plow is concentrated on its land-side, but the necessity of overcoming this result, and how to do it, are for the first time shown in this implement, in which a lubricated axle is substituted for a dry, flat, metallic surface, pressing and grinding against the grit of the soil in which it is used. The result is inevitable and so apparent that we will pass to the consideration of other valuable features. The absence of a land-side permits the plow to be turned in its own length, the nose of the share operating like a pivot, and can be turned in or out, hence square corners can be turned, and other results accomplished, which the presence of a land-side would render impossible. Every sulky plow made in the old style has more or less friction on the shoe of the land-side, as that part sustains more or less weight, according to the construction of the carriage; but in the "Casaday" there is no such friction, as there is no land-side upon which the plow can rest. Every pound is thrown on to and sustained by the lubricated axle spindles, which offer no resistance to the progress of the plow through the soil. Again, a land-side is a serious obstacle to a plow entering the ground, especially in gravelly and hard baked soils, but the "Casaday," having only the sharp edge of its share to offer resistance, effects an easy entrance to any required depth, and the entire weight is borne by the axle of the carriage. The back of the mold-board, sloping upward and backward, permits stones to be passed over with ease that would throw an ordinary land-side plow entirely out of the ground. The "Casaday" glides over them, and seeks entrance into the soil the moment the edge of its share has passed the obstruction, instead of having to run the entire length of a land-side before it can resume work.

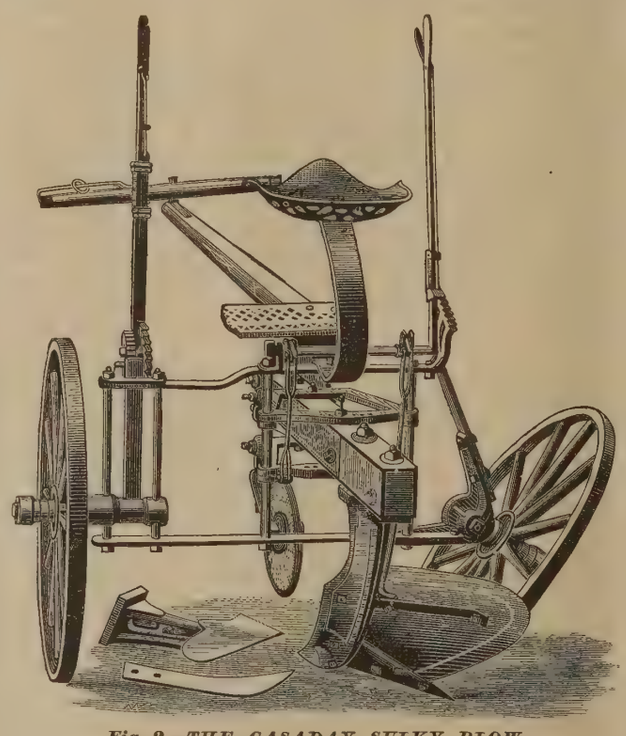


Fig. 2.—THE CASADAY SULKY PLOW.

2d. The slotted standard heads permit the position of the mold-board to be changed to suit the soil and work, by loosening two bolts. The same mold will do fine work in sod or stubble by means of this adjustment, a merit possessed by no other sulky. The mold can also be raised or lowered at its heel, by a joint in the tongue, which is hinged to the front end of the beam. 3d. Depth of furrow is regulated by one lever, which is also used to lift the plow from the ground, and the width is regulated by sliding the beam to or from the land. 4th. The land-wheel is controlled by one lever, which is used to level the plow on hill sides, or when working in dead furrows. This lever has a vibrating spring, which permits the wheel to play vertically on uneven ground, and keeps the furrow bottom true and even in depth in old corn ground, and similar work. 5th. The tongue has a hinged joint, and can be raised or lowered to suit every requirement. The neck-yoke has a sliding ring for the land horse, which gives the furrow horse full and absolute control of the guiding of the plow, thus preventing crowding and pulling, and securing straight furrows, while in corn ground the land horse can walk on either side of the rows. 6th. The attachments consist of a hanging coulter, which can be raised or lowered, and brought to or from the land, to keep it in cutting line with the front of the plow. The rolling coulter is operated by a bell-crank for side adjustment, and a vertical movement for depth. The jointer has a side and vertical adjustment, and is of inestimable value to farmers. One harrowing on work done with it leaves the ground in better condition than two will without it. It puts foul growth and trash of all kinds where it will do most good—in the bottom of the furrow, to rot and enrich the soil, leaving the seed-bed, to the depth of 5 or 6 inches, to contain nothing but loose, mellow earth. In plowing sod for corn or other spring crops, the grassy edge between the furrow slices is never covered with more than one or two inches of loose earth by the harrow. It is from this point that the grass first starts up among the growing crops. The jointer cuts away this edge and puts it on the bottom of the furrow, burying it so deep that the grass smothers out, leaving 4 or 5 inches of loose, mellow earth above it, instead of 1 or 2, and leaving the soil in better condition to receive the crop, and requiring less cultivation to keep it clean and mellow afterward. For turning under clover, weeds, long stubble, manure, straw, etc., it is almost equally valuable. 7th. The frame-work is all iron, securely bolted, combining lightness with strength. The manufacturers have not sacrificed the latter for appearance or econo-

my, but every part is strongly built, and intended for use rather than looks. 8th. Shares and molds are made in the following combinations: Steel molds with steel shares; steel molds with cast-iron shares; chilled molds with steel shares; and chilled molds with cast-iron shares.

The manufacturers use only the best quality of soft center steel, well tempered. The cast-iron shares are made of the best quality of charcoal iron, and are chilled on the nose and cutting edge. Their use is recommended where possible, as being cheaper than steel. The capacity of the sulkies is as follows: No. 14 will turn a furrow from 14 to 16 inches and any required depth. No. 14–10 will turn a furrow as wide as 18 inches, and same depth as No. 14.

We recommend all interested in these plows to address the Oliver Chilled Plow Works, South Bend, Ind., or to their branch houses at Mansfield, O.; Dallas, Tex.; and Indianapolis, Ind.

Latest Market Report of Building Materials.

NEW YORK PRICES.

ARTICLES MARKED WITH A STAR (*) ARE QUOTED IN GOLD.

—o—

LUMBER.

Pine, very choice and extra dry, per M	$55 00 @ 60 00
Pine, good	45 00 @ 50 00
Pine, shipping box	18 00 @ 22 00
Pine, common box	16 00 @ 17 00
Pine, common box, ⅝	13 00 @ 15 00
Pine, tally plank, 1¼, 10 inch, dressed, each	40 @ 43
Pine, tally plank, 1¼, 2d quality	35 @ 38
Pine, tally plank, 1¼, culls	25 @ 28
Pine, tally boards, dressed, good	28 @ 30
Pine, tally boards, dressed, common	22 @ 25
Pine, tally boards, culls, dressed	21 @ 23
Pine, strip boards, merchantable	16 @ 18
Pine, strip boards, clear	22 @ 25
Pine, strip plank, dressed, clear	33 @ 35
Spruce boards, dressed	18 @ 20
Spruce plank, 1¼-inch, dressed	22 @ 25
Spruce plank, 2-inch	28 @ 34
Spruce wall strips	13 @ — 15
Spruce timber, per M	16 00 @ 19 00
Hemlock boards, each	14 @ — 16
Hemlock joist, 2½x4	15 @ — 16
Hemlock joist, 3x4	16 @ — 18
Hemlock joist, 4x6	40 @ 44
Ash, good, per M	38 00 @ 45 00
Oak	38 00 @ 45 00
Maple culls	20 00 @ 25 00
Maple good	42 00 @ 45 00
Chestnut	42 00 @ 48 00
Cypress, 1, 1¼, 2, and 2½-inch	35 00 @ 40 00
Black walnut, good to choice	85 00 @100 00
Black walnut, ⅝-inch	75 00 @ 85 00
Black walnut, selected and seasoned	110 00 @150 00
Black walnut counters, per ft	12½ @ 20
Cherry, wide, per M	85 00 @100 00
Cherry, ordinary	60 00 @ 80 00
White wood, chair plank	60 00 @ 70 00
White wood, inch	40 00 @ 50 00
White wood, ⅝-inch	30 00 @ 35 00
White wood, ⅝ panels	35 00 @ 40 00
Shingles, extra shaved pine, 18-inch	9 50 @ 10 00
Shingles, extra shaved pine, 16-inch	8 50 @ 9 50
Shingles, extra sawed pine, 18-inch	7 00 @ 8 00
Shingles, clear sawed pine, 18-inch	6 50 @ 7 50
Shingles, cypress, 24x7	20 00 @ 22 00
Shingles, cypress, 20x6	12 00 @ 15 00
Lath, Cargo rate	1 40 @ 1 45
Yellow dressed pine flooring	25 00 @ 35 00
Yellow pine girders	30 00 @ 40 00
Locust posts, 8 feet, per inch	18 @ 20
Locust posts, 10 feet	24 @ 25
Locust posts, 12 feet	29 @ 34
Chestnut posts, per ft	3 @ 3½
Basswood per M	25 00 @ 30 00

BRICKS.

Nominally.	Cargo.	Afloat.
Pale, per M.	2 25 @ 2 50	
Jersey	— — @ — —	
Long Island	— — @ — —	
Up-River	3 50 @ 4 00	
Haverstraw Bay	4 00 @ 4 25	
" " choice	4 37½ @ 4 50	
Favorite Brands	5 00 @ 6 00	

FRONTS.

Croton—Brown, per M.	— — @ 7 00
" Dark	— — @ 8 00
" Red	— — @ 9 00
Philadelphia	26 00 @ 28 00
Trenton	24 00 @ 29 00
Baltimore	34 00 @ 38 00

Yard prices 50 cents per M higher, or with delivery added $2 per M for hard and $3 per M for front brick. For delivery add $5 on Philadelphia and Trenton, and $6 on Baltimore brick.

IRON—PER TON.

Pig, Scotch—Coltness	23 00 @ 24 00
Gartscherrie	— — @ — —
Glengarnock	22 50 @ 23 25
Eglinton	21 50 @ 22 50
American, No. 1	16 50 @ 18 50
American, No. 2	15 50 @ 17 50
American, forge	14 50 @ 16 00

Store prices. Cash.

Bar, Swedes, ordinary sizes	— 5 @ — 6
Ba., Swedes, nail-rod	— — @ — 6½

LEAD—PER 100 POUNDS.

*German	— — @ — —
*English, common	— — @ — —
*Spanish	— — @ — —
*Foreign, refined	— — @ — —
*Bar	5 00 @ — —
*Sheet and Pipe	5 00 @ 6 00
*Domestic	3 37 @ — —

ZINC.—Duty, sheet, 2½ cents per lb.

NAILS—PER KEG.

10d to 60d, common, fence and sheathing	2 30 @ — —
8d and 9d, common	2 85 @ — —
6d and 7d, common	3 10 @ — —
4d and 5d, common	3 35 @ — —
3d and 4d, light	4 10 @ — —
3d, fine	4 85 @ — —
2d, fine	4 85 @ — —
Cut spikes, all sizes	2 85 @ — —
Clinch nails, 1½ to 1¾ inch	5 00 @ 5 25
do. 2 to 2¼ inch	4 75 @ — —
do. 2½ to 2¾ inch	4 50 @ — —
do. 3 inch and longer	4 25 @ — —

TIN PLATES.—Duty, 1 1-10 cents per pound.

*I. C. charcoal, 10x14, per box	6 00 @ 6 25
*I. C. coke, 10x14	5 00 @ 5 75
*I. X. charcoal, 10x14	8 00 @ 8 25
*I. C. charcoal, 14x20	6 00 @ 6 25
*I. X. charcoal, 14x20	8 00 @ 8 25
*I. C. coke, 14x20	5 00 @ 5 75
*I. C. coke, terne, 14x20	5 00 @ 5 25
*I. C. charcoal, terne, 14x20	5 50 @ 5 75
Sheet, (cask) per lb	— 6 @ — 6¼
Sheet, (open)	— 6½ @ — 6⅝

STONE.—Cargo Rates.

Amherst Freestone, in rough, per cubic foot	— — @ — 85
Berlin Freestone, in rough	— — @ — 95
Berea Freestone, in rough	— — @ — 75
Brown-Stone, Portland, Conn	1 25 @ 1 50
Brown Stone, Belleville, N. J	1 00 @ 1 50
Granite, rough	— 60 @ 1 25
Canaan Marble	1 25 @ 1 50
Dorchester, N.B., Stone, rough, per foot	— — @ 1 03

SOLDERS.

No. 1	— 9 @ — 10
No. 2	— 8½ @ — 9

PLASTER PARIS.

Duty.—20 per cent ad. val. on calcined; lump free.

Nova Scotia, white, per ton	2 80 @ — —
Nova Scotia, blue	2 75 @ 2 80
Calcined, Eastern and city, per bbl	1 00 @ 1 10
Calcined, city casting	1 15 @ 1 25
Calcined, city superfine	1 25 @ 1 50

LIME—PER BARREL.

State, common	— 80 @ — —
" finishing	— 90 @ — —
Rockland, common	— 60 @ — —
" finishing	— 90 @ — —
Ground	— 80 @ — —

Add 25 cents to above figures for yard rates.

CEMENT—PER BARREL.

Portland (imported)	2 75 @ 3 25
Portland (American)	2 50 @ 2 90
Roman	2 80 @ 3 25
Keene's, coarse	6 50 @ 7 00
" fine	10 00 @ 10 50
Martin's, coarse	6 00 @ 6 50
" fine	10 00 @ 10 50
Rosendale	— 80 @ — 90

DEADENING AND ROOFING MATERIAL.

Mineral Wool for Roofs and Deadening, per lb.	— 1¼ @ — 1½

HAIR.

Cattle, per bushel of 7 lbs	— — @ — 10
Goat, " "	— — @ — 12½
Vegetable Fiber (substitute for hair) per lb.	— — @ — 20

SLATE.

Purple roofing slate, per square	$6 00 @ 7 00
Green slate	6 00 @ 7 00
Red slate	10 00 @ 11 00
Black slate, Pennsylvania	5 00 @ 5 25
Slate tiles, 1¼-inch, rubbed, per square foot	20 @ 25

PAINTS.

*Carmine, American, per lb. gold	5 00 @ 5 50
Chalk, per lb	— 00¼ @ — 00⅜
China Clay, per ton gold	20 00 @ 22 00
Chrome yellow, dry, per pound	— 12½ @ — 28
Lead, red American, per pound	— 7 @ — 8
Lead, white American, pure, in oil	— 7½ @ — 8
Lead, white American, pure, dry	— 6¾ @ — 7¼
Lead, white English, pure, in oil gold	— 10 @ — 10½
Litharge	— 7 @ — 8
*Ochre, Fr., dry, per 100 lbs	1 50 @ — —
Ochre, ground, in oil, per lb	— 6 @ — 15
Ochre, Vermont, per 100 lbs	— 75 @ 1 00
*Orange Mineral, English gold	— 9½ @ — 10
Paris White, American	— 1¼ @ — 1½
Paris White, English, prime	— 1¾ @ — 2
Paris Green	— 15 @ — 28
Plumbago paint, patent, per lb	— — @ — 25
Putty, per lb	— 1¾ @ — 2½
Spanish Brown, dry, per lb	— 1⅞ @ — 1¾
Spanish Brown, ground in oil, per lb	— 8 @ — 9
Venetian red, per cwt	1 75 @ 2 00
*Vermilion, Chinese, per lb	— 80 @ — 90
*Vermilion, Trieste	— 70 @ — 80
*Vermilion, quicksilver, bags gold	— 55 @ — 57½
Vermilion, American, common	— 15 @ — 18
Whiting, per 100 lbs	— 40 @ — 75
Zinc, white American, dry, No. 1	— 6½ @ — 7½
Zinc, white American, No. 1, in oil	— 8 @ — 10
*Zinc, white French, dry, (Red Seal,) gold	— 8 @ — 8¼
Zinc, white French, in oil gold	— 10 @ — 10½

VARNISHES—PER GALLON.

American Wearing Body	3 50 @ 4 00
Coach Body	2 35 @ 3 50
do do	1 80 @ 2 00
Furniture	1 25 @ 2 50
Black Asphaltum	1 00 @ 1 50
Brown Japan	1 00 @ 1 20
Liquid Paint Dryer	1 35 @ 1 75
Harness, (black)	3 00 @ 4 50
Shellac, Spirits	3 00 @ 3 50

FOREIGN WOODS.

MAHOGANY.

St. Domingo, crotches, ordinary to good, per ft	— 20 @ — 25
St. Domingo, crotches, fine	— 25 @ — 60
St. Domingo, logs, small	— 5 @ — 8
St. Domingo, logs, large	— 8½ @ — 14
Frontera, Mexican, large	— 9 @ — 13½
Frontera, Mexican, small	— 7 @ — 8
Other Mexican	— 7 @ — 13
Honduras	— 7 @ — 13

CEDAR.

Cuba, per superficial foot	— 8 @ — 12
Mexican, small	— 8 @ — 9½
Mexican, large	— 10½ @ — 12
Florida	— 40 @ — 75

DOORS, WINDOWS, AND BLINDS.

DOORS, RAISED PANELS, TWO SIDES.

2.0 x 6.0	1¼ inch.	$ 75 —
2.6 x 6.6	1¼	1 05 —
2.6 x 6.8	1¼	1 10 —
2.8 x 6.8	1¼	1 15 —

DOORS, MOLDED.

Size.	1¼ inches.	1½ inches.	1¾ inches.
2.0 x 6.0	$1 37	—	—
2.6 x 6.6	1 69	2 14	—
2.6 x 6.8	1 73	2 16	—
2.6 x 6.10	1 76	2 23	—
2.6 x 7.0	1 80	2 32	—
2.8 x 6.8	1 80	2 32	2 85
2.8 x 7.0	1 88	2 41	2 99
2.10 x 6.10	1 98	2 51	3 46
3.0 x 7.0	2 07	2 71	3 33

WINDOW FRAMES.

Up to 3.4 x 7.2, put together	2 30 @ — —

INSIDE BLINDS.

Per lineal foot, 4 folds, pine	50 @ — —
Per lineal foot, 4 folds, ash or chestnut	— 80 @ — —
Per lineal foot, 4 folds, cherry or butternut	— 95 @ — —
Per lineal foot, 4 folds, black walnut	1 15 @ — —

GENERAL REVIEW OF THE MARKETS.—Business the past month has shown a firmer tone, but demand has not increased to any great extent. The firmness that has developed has been most apparent in the markets affected by the closing of navigation, but nearly all have gained more or less in strength. In fact business seems to be in better shape in every way than it has been for some time past, and we think the outlook for spring trade very encouraging. General business seems to have settled down to a solid old fashioned basis, and merchants look hopefully at the situation; they have learned some useful lessons and seem to be content with the small profits that the revolution in trade has brought about. Nor do they anticipate a return of great prosperity, but only to that healthful condition of trade which prevailed before the era of inflation.

THE MARKETS IN DETAIL.—In the lumber market the past month business has been extremely slight, with a falling off, if anything, from the amount of trade done during the month of November. Buyers have been very indifferent except for export, supplies only being taken for actual necessities. Values, as a rule, have been steady, and in some cases there has been an inclination to talk more firmly; still when a good fair bid has been made holders have not been able to resist the temptation of accepting it.

In the brick market trade has shown a firmer tone. The ice has shut off communication with the river points of supply, and this has, of course, had a tendency to stiffen prices.

In the lime market we retain former prices and the position is necessarily nominal for the time being. As with other material just now the jobbing distribution has been small, but stocks have not been large, and holdings have been pretty steady at a fair line of cost, according to quantity handled and mode of delivery.

In the lath market, in a wholesale way, there has not been much doing since the writing of our last report, owing mainly to the absence of supplies. From indications there is nothing to show that buyers would handle any great amount of stock even if offered, but any afloat at this season of the year is certain to be sold without much difficulty.

In the hardware market demand generally has been moderate, and confined principally to local orders.

In the paint market there has not much being doing, and most of the distribution has been confined to small lots of standard goods. Holders have offered to a fair extent, and generally on a basis of former figures, but have not been urging business.

In the metal markets American pig has sold mostly on small orders and there has not been many of these, the market presenting rather a quiet appearance; Scotch pig was active during part of the month, but has again settled down. Manufactured iron has remained steady with a fair average of business doing. Domestic pig lead has been firmly held and offered somewhat moderately. Pig tin has been quite unsettled on price for all descriptions, but with a recent general sort of tendency in favor of the buyer, owing to the moderate and indifferent call for stock. Tin plates have continued to find a good jobbing sale and have generally ruled pretty steady on prices.

The Michigan Salt Works.

The principal salt wells are at Saginaw, Mich., where the brine is found at depths of from 600 to 1,100 feet. The capacity of these wells varies in different localities, from 12 to 20 gallons per minute, the size of the well and porosity of the sand rock having much to do in increasing the amount. A good well will fill a cistern 20 × 30 × 6 feet in about 20 hours. A salt well in Saginaw City, owned by Pierson, Wright & Co., produced enough brine during a manufacturing season of eight months to make over 26,000 barrels of salt. At East Tawas, the wells, 3½ inches in diameter, fill a cistern of the above size in about 12 hours. At Port Austin the well fills a cistern in 17 hours.

The cisterns for settling the deposit in the brine were formerly built 20 by 30 feet and 6 feet deep, having a capacity of 25,000 gallons. More recently the size has been increased. They are built of sound 2 to 3 inch plank, well and properly keyed together by strong gripes, and are also calked to prevent leakage. These cisterns are elevated on piling or framed timbers, high enough to allow the settled brine to flow through pipes to the blocks.

The brine contains a small percentage of carbonate of protoxid of iron, held in solution by an excess of carbonic acid. If it was boiled down with this iron in it, it would give the salt a red color, and very materially affect its commercial value, therefore, as soon as the cistern is filled with brine, preparation is made to settle it. A tight box large enough to hold a barrel or more of water is placed on the top of the cistern. In this a proper quantity of fresh burnt lime is slacked with fresh water, enough being afterward added to fill the box, so as to make a whitewash or milk of the lime. This mixture being a caustic lime, is freely sprinkled over the brine. The brine is then thoroughly stirred up until the lime is well mixed with it. The caustic mixture of lime having a strong affinity for the carbonic acid, extracts the same from the brine, thus releasing the iron, which is precipitated with the lime to the bottom of the cistern as an insoluble peroxid of iron. The brine is then allowed to rest for 48 hours, when it is quite clear and ready for the boiling-house or block. On the care with which the settling is conducted depends much of the success in making good salt.

The next process is the evaporation; this is effected by three different methods: 1st. By the direct application of fire-heat to kettles and pans. 2d. By the use of steam, either exhaust steam from saw-mills or steam generated by flue-boilers built expresely for the purpose. 3d. By solar evaporation.

A kettle block for the evaporation of brine consists of a wooden building, 140 feet long by 45 to 50 feet wide, with an elevation of 18 feet, so arranged as to admit of the steam passing out of the ventilators. In this building are set from 50 to 60 kettles, each having a capacity of from 100 to 120 gallons. The kettles are set in two rows over arches running from the mouth of the furnace to the chimney. These are called "arches." These arches run close together, with a dividing wall between them; the kettles are set close together in a row, resting on the dividing wall on the one side and on the inside wall on the other. The fire arch or furnace at the front is 3 feet from the bottom of the kettles; from here the bottom of the arch gradually rises so that under the back kettles the space is only from 10 to 12 inches. Here the flue passes into the chimney, which is from 40 to 50 feet high.

Between the arches and he salt bins, which are under the same building, is the sidewalk. On this sidewalk the salt-boiler operates in drawing the salt from the kettles into the draining baskets, which, when it is sufficiently drained, are wheeled off to the salt bins on this sidewalk or platform. The bins, which run the entire length of the block, are divided off in sections, and are made with open floors for the proper drainage of the salt. Through the center of the block, just on top of the middle wall, two sets of pump-logs or pipes are laid, one for fresh water and one for the settled brine, each of them being supplied with faucets for each kettle. The kettles, after being well cleansed, are filled with brine, and boiling soon commences after the fire is under good headway. A scum rises to the surface, which is taken off with a skimmer.

Soon after the brine commences to boil, the crystals of salt commence to form on the top, and then fall to the bottom. When the brine is boiled down to about one-third, the salt is dipped out with a ladle and thrown into a basket, which is placed over one side of the kettle. The salt is allowed to remain in the basket for two or three hours, the bitter water containing the earthy chlorids being thus drained off. Thorough drainage is an important point in the mode of manufacture. The balance of the brine or bitter water remaining in the kettle is now bailed out and thrown into the drainage trough. The kettle is then rinsed out with fresh water, and again filled up with brine. The kettle blocks are generally run day and night by four men, two boilers and two firemen, taking tours of twelve hours each. The average product of a good kettle block is 75 barrels of salt per day of 24 hours.

Another method of evaporating the brine by fire is not done in kettles, as above described, but in pans, and the series of kettles containing them are called "pan blocks." They are constructed of various dimensions, and built to accommodate the size of the pan, settlers, and salt bins. The pans are made of ¼-inch boiler-plate iron. They vary from 90 to 120 feet in length, being divided into sections of 30 or 40 feet, are 12 to 15 feet wide, and from 10 to 12 inches deep. With some the sides are straight, the salt being raked to the side, lifted out with a shovel, and thrown on the draining boards. In others the sides are flanged, and the salt is raked directly on to the draining boards. Pans of the above size rest on three walls as in kettle blocks, the arches running directly under the pan to the chimney at the end. As the firing of these blocks is done mostly with slabs or light fuel, the first 30 or 40 feet are also protected by patent arches thrown across the flues, thus dividing the heat more generally throughout the block. The brine boils very rapidly in these blocks, and as the salt makes fast, it requires much care and attention on the part of the workmen to keep the salt from baking on the bottom of the pan; this is prevented by raking out the salt almost as fast as it makes.

Improvements in heating pan blocks have been made of late years in those localities where the price of fuel is a consideration. An improved pan block is some 120 feet long and 40 feet wide; this length is calculated for four pans. Three pans are each 30 feet long and 16 feet wide on the bottom, the sides flanging and bolted to the draining boards. They rest on seven walls, so arranged that they make two fire flues in the center and two return flues on the sides.

The center and outside walls run the entire length and width of the pan. All the walls are a foot wide at the top. The two fire flues which are under the middle of the pan on both sides of the center wall are 2½ feet wide; hight of grate to pan, 3½ feet. The return flues are next to the outside walls, under the sides of the pan, and are 2 feet wide. This gives a heating surface of 180 feet in length on both sides of the middle wall. The outside flues run into the chimney, which is placed at one side of the front of two blocks, the space under the pan being reduced to 12 inches. The advantage of this arrangement of the flues is that, as the brine boils freely over the fire flue, the salt, as it makes, is thrown to the cool side of the pan, and therefore is not liable to bake to the bottom of the pan before it is raked out. Another advantage is in the economy of the heating surface, the entire amount of heat being well used up before it gets to the chimney. This is shown in the amount of salt made; Ayres & Co., of Port Austin, Huron county, who have such improved pans, report the making of 140 barrels of salt with 13 cords of hemlock wood in a day of 24 hours.

The brine for pan blocks is settled cold in the outside cisterns, and in most instances is brought to saturation by the inside steam settlers. The salt, as it makes in the pan, is drawn out by rakes upon the draining boards, where it remains for a time, when it is shovelled into barrows and taken to the store bins for further drainage. It is very desirable that the draining boards should be so arranged in pan blocks that the workmen should not be compelled to walk over them in the operation of drawing or wheeling off the salt.

In our next we will explain the improved method of evaporating the brine by steam and by solar heat.

A Large Gun Casting.

An enormous tube of cast-iron, which is to form a part of a breech-loading gun weighing 1,000 tons, has recently been successfully constructed in the foundry of the Italian government, near Turin. The diameter of the bore of this modern piece of ordnance will be 16 inches, the weight of the projectile thrown by it will be very nearly one ton, and the charge will consist of about 5 cwts. of powder. The cast-iron parts of the gun, which alone weigh more than 60 tons, will be strengthened by rings of steel.

The iron used was melted in 11 large furnaces, situated at some distance from one another, and then conveyed into a large receptacle especially constructed for the purpose near the place where the form was arranged. This latter consisted of a cylinder of cast-iron, lined with a thick layer of perfectly dry earth; while the core was formed by a hollow iron cylinder coated with clay, through which a stream of water flowed. Four tubes led from the receptacle in which the molten iron was collected into the form, one entering this latter near its base, another near the top, and the others at intermediate points.

The heating of the furnaces began at 3 o'clock in the morning; at 10 the molten iron was conveyed into the great receptacle, an operation which was performed in 35 minutes, and in less than half an hour afterward the casting was completed, not a single hitch or accident of any kind having taken place during the whole work. When finally completed, the gun will be rather more than 30 feet in length, and the diameter of the breech, where it will be strengthened by steel rings, will be about 6 feet.

Pig-Lead from Smoke.

The following is the explanation of the *Mining News* (Joplin, Mo.) respecting the statement that pig-lead is being made from smoke: "In the process of smelting the ore a great deal of it escapes in the form of lead fumes, and the White Lead Company was organized for the purpose of catching this smoke, and, by passing it through an almost endless line of pipes of sheet-iron and woollen bags, condense it. The result was that after an outlay of many thousand dollars and a year's experimenting, they have succeeded in condensing the smoke, or lead fumes, into metallic lead, the same as steam is converted into water. The product of the fumes is a bluish, impalpable powder, which makes a splendid blue paint, pronounced equal to the corroded article. For the purpose of making it white several furnaces were built, and the blue product, with the aid of an intense heat, is again changed into lead fumes, which are again condensed, and come out pure white lead. In the transforming of the blue lead into fumes considerable pig-lead is made. The object is to sublimize it all, but the heat is not powerful enough to do so."

LONGEVITY OF TREES.—The longevity of various trees has been stated to be, in round numbers, as follows: Deciduous cypress, 6,000 years; boabab tree of Senegal, 5,000; dragon's blood tree, 4,000; yew, 3,000; cedar of Lebanon, 3,000; olive, 2,500; oak, 1,600; orange, 1,500; Oriental palm, 1,200; cabbage palm, 700; lime, 600; ash, 400; cocoanut palm, 300; date palm, 300; larch, 300; pear, 300; apple, 200. The Brazil vine palm arrives at the age of 150 years; the Scotch fir gets its growth in about 100 years, and the Balm of Gilead in about 50.

Home Department.

Object Teaching.

CONTINUED FROM PAGE 275, VOL. X.

The ball exercise may be continued by causing the ball, suspended by a thread, to ascend and descend by winding the thread around the finger and unwinding

Fig. 8.

it again; then letting the ball describe a circle, or spiral, as represented in Fig. 8, where the spiral becomes larger and larger, and in Fig. 9, where it moves in an opposite direction and describes a spiral curve, becoming smaller all the time. This may be varied by making the thread longer or shorter, or changing its length by letting it wind around the finger, (see Fig. 9), or letting it unwind, (see Fig. 8), in which case the spiral will vary accordingly. During this exercise it is suggested to let the children recite the following rhyme:

Now the ball is sinking; see
How it is rising up to me.
Sinking—rising,
Sinking—rising.
Tell me, children, as it flies,
How the ball can sink and rise?

The next exercise is represented in Fig. 10, and shows how the child can pull the ball towards him

Fig. 9.

from the box, until it come off, (Fig. 11); and the teacher should say in Fig. 10, "Pull, pull, pull;" when that of Fig. 11 is reached, he says, "Now you have it."

Next, two strings may be attached to the ball, and the same made to rotate around its perpendicular axis, by twisting and then pulling the strings, as seen in Fig. 12.

In Fig. 13 the child is made to grasp the ball on command; in Fig. 14 to release it and let it rest on its hand. Then the color of the ball can be considered and compared with known objects, while, when the play is finished, the ball is dropped into the box, Fig. 15, and the children sing or speak as follows:

Now it joins its little sisters,
And will stay at rest;
Close the lid—close baby's eyelids;
Put him in the nest.

These exercises may appear silly, but it must be remembered that they are for very young children. When they are older new ideas may be added; for instance, when swinging the ball round on the string, the child is taught to sing:

See the windmill, how it goes,
While the wind so briskly blows;

Fig. 10.

Always turning round and round.
Never idle is it found.

Then the children are made to stretch out their right hands, and a ball is given each of them; they must every time say, "Thank you," as a lesson in politeness. Then they must describe the ball, saying, "The ball is green, the ball is soft, the ball is round," etc., and they must be made to say this correctly and distinctly, so as to develop their manner of speech, because if at this time of life they learn to speak well, they will naturally read better afterward.

Then they may be taught to throw up the ball and catch it again; then to stand in a circle and hand the balls round; if one of them drops, it should remain on the ground until afterward. This exercise must be done quickly and gracefully, and an appropriate verse recited or sung while the various colored balls go round, such as:

Red and yellow, green and blue,
Mingling with a purple hue;
All the rainbow tints I see
As the balls come round to me.

Frœbel's System of Education.

Frederick Frœbel, the founder of the Kindergarten system of education, was born in Germany, and became a pupil of Pestalozzi, and an ardent admirer of his method of teaching. Frœbel, however, soon discovered the want of something better calculated to interest and

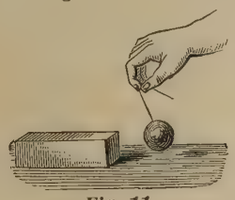


Fig. 11.

engage the active powers of the youngest child. He carefully studied the child in its spiritual, moral, intellectual, and animal nature. He perceived that, by the old systems of instruction, the harmonious and gradual development of all the faculties was not secured, but that the memory was often overtaxed, moral sentiment neglected, or the physical powers stunted, while the inventive or creative faculty innate in every child remained undeveloped. He watched nature in the vegetable kingdom, where plants grow freely in good soil and pure air, needing but the aid of the cultivator for their perfect development. In beautiful accordance with the teachings of Nature, he arrived at the conclusion that the teacher of youth should not attempt to force the mind, but simply use the right means and materials by which knowledge may be obtained, direct the awakening faculties, form the habits, educate the feelings, and preserve a pure atmosphere and good influences around the tender human plant.

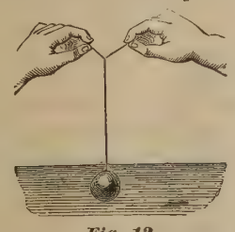


Fig. 12.

"We must begin at the beginning," said Frœbel, after having devoted nearly a life-time to the education of scholars beyond childhood. "Too much has to be undone in later years, that has been done wrong from the outset." He therefore addressed himself to mothers—to the whole female sex, to whom the care of infancy is committed. In his book of "Mother's Cosseting Songs" Frederick Frœbel laid down his views on infant education.

For the age of from three to seven he devised his Kidergarten, as an intermediate step and connecting link between the child's home-life and the school, which brings the child into contact with children of his own age, enhances his pleasure in following the same pursuits with them, and plants the seeds of social virtues. During his life-time Frœbel was understood and appreciated only by a few superior minds. In order to make his ideas more widely known, this unselfish man practiced much self-denial, and travelled many miles, frequently resting on the green sward at night with an umbrella for his roof and a knapsack for his pillow." Toward the close of his life his labors were rewarded with success, for he lived to see many Kindergartens, (Child-Gardens), as he called them, established in Germany.

The Kindergarten is an institution providing employments and exercises for the healthful and harmonious development of all the faculties of children from

Fig. 13.

three to seven years of age. Frœbel's motto was: "Play is the work of the child." The toys used, Frœbel termed "gifts." The first and second gifts are used for the child in the nursery, and mothers and nurses who know their use and value, readily commend them to others. The third, fourth, fifth, and sixth gifts belong to the Kindergarten. These gifts consists of boxes of cubes, variously divided, which are used to give pleasant lessons in numbers, or the elements of arithmetic, in form and invention. They develop the constructive faculty, and with the aid of stories, anecdotes, and useful information, according to the teacher's tact, are made to convey much simple instruction concerning the laws of nature and common things. Little children cannot, in accordance with their nature, sit still for any length of time, even to look and listen—their constant anxiety is to have something to do, and hence the many employments for the fingers and feet, as well as for the eyes and ears, which Frœbel sug-

Fig. 14.

gested, meet in an admirable manner the child's wants.

Colored papers for plaiting, clay for modelling, sticks for laying figures on the table, and a slate ruled in squares for the elements of drawing, folding of paper, by means of which the elements of geometry are taught, afford a variety of employments which must be seen to be rightly understood and appreciated.

Active games, with songs of the most innocent and instructive kind, form a part of the daily exercises of the Kindergarten, all of which are best conducted in connection with a large garden and country scenery, that noble impressions may be derived from nature, and space afforded for the little folks to see and occupy themselves with gardening.

It will be evident that the principle of the Kindergarten system, which so admirably combines thinking and working, is not limited to infant education—the structure reared must rest upon and accord with the

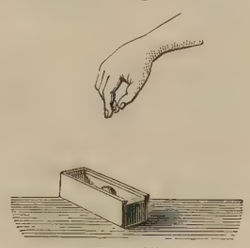


Fig. 15.

foundation laid; as the child advances from seven to twelve years of age and upwards, the teacher has but to supply the means of progress in knowledge suited to the requirements of the pupils; books are then used by them with intelligence and interest, and, in the development of their growing capabilities, they will be successfully taught to teach themselves.

Mineral Wool.

The increasing demand for this valuable article has necessitated the mineral wool factory at Mr. Parrott's blast furnace in Orange Co., N. Y., to work double time, and to be enlarged. Within the past month orders have been received for covering with mineral wool all heating and steam apparatus in the new Capitol at Albany, also, for repairs in the U. S. Assay Office and Sub-Treasury, N. Y., for protecting cold water pipes on the piers of the Pennsylvania Railroad Company in this city, for several large ice-houses in hotels, breweries and packing houses, and for lining roofs and walls of private residences.

It is very likely, judging from present results, that walls of *hard wood* finish, lined with mineral wool, will soon take the place of lath and plaster and soft brick filling in the construction of stylish and comfortable country houses. As to having the roofs of dwellings properly protected against heat and cold the result is said to be such, that from being first considered a *comfort* as regards the temperature in a house, it grows to be an imperative necessity—when once used to it.

Address for particulars Mr. A. D. Elbers, 26½ Broadway, New York.

Scroll-Saw Machines.

We have received from Messrs. W. F. & John Barnes, of Rockford, Winnebago Co., Ill., a small but beautifully illustrated catalogue and price-list of their foot-power machines. It appears that these machines are beginning to be more and more appreciated, and to meet with an increasing sale. They consist of turning-lathes, scroll-saws, grinding and polishing machines, drilling-machines, tenoning machines, etc. Many mechanics have taken advantage of the cheapness of these tools and provided themselves with a complete outfit, with which they carry on business. As an instance, we will give an extract from a letter from Mr. A. C. Huntington, of La Grande, Oregon, who, while sending $105 and orders for additional tools, writes: "I know the value of your machines, for with your large size scroll-saw I have made over $200 in twenty days."

Miscellaneous and Advertising.

The Valley Machine Company, of Easthampton, Mass., recently shipped ten of their celebrated steam-pumps to San Francisco, and four to Galveston, Tex.

We call the attention of cabinet-makers, carpenters, and others to the great bargain offered by the Turner Manufacturing Co., of 93 Water street, Boston, Mass., in our advertising columns.

The deadly sewer-gas which has made such sad havoc in many homes could have been warded off by the use of Carr's Defiance Water-Closet. It completely prevents the gas arising and offers one of the most efficacious checks against this source of contamination. Wm. S. Carr & Co., of 108 and 110 Center streeet, New York, the manufacturers of this closet deal also in general plumbers' supplies, and furnish anything in this line that may be required.

An ingenious machine for wood-workers will be found in Wood's hand circular-saw, rabbeting and tenoning machine. This machine has from long use proved its perfect adaptability for doing the kinds of work indicated by its name and it is praised in the highest terms by all who have used it. The manufacturer, J. A. Wood, of Lawrence Station, N. Y., received the first prize for his invention at the American Institute Fair in 1870 and silver medal in 1875.

If demand is a criterion of merit then Knowles' pumps must possess the latter to a very high degree. The sales of these pumps, already immense, are steadily increasing both for home use and for export. Prominent among the various pumps of this make are the Knowles boiler-feed pumps, fire pumps, noiseless pumps and mining pumps. Every machine sold by the manufacturers, the Knowles Steam Pump Works, of 92 and 94 Liberty street, New York, is furnished under a complete guarantee, and purchasers may therefore rest assured that every representation made will be sustained.

In no branch of machinery has the brain of the inventor been taxed to a greater degree than in perfecting the divers devices for barrel and stave making, and we do not know of an instance where such brain labor has produced grander results. The perfection we speak of has been attained to its highest degree in the machines manufactured by John Greenwood & Co. of Rochester, New York, who are among the largest producers of barrel and stave machinery. It will only be necessary to obtain the catalogue of this firm to appreciate the force of what we have here stated, and we advise those interested to send for same at once.

No building is complete without the improved steel shutters of Clark & Co. They are vastly superior to the ordinary shutters in construction, and are noiseless and self-coiling. In addition to these shutters, the above firm also manufacture rolling wood shutters of various kinds for residences, etc. This firm have their manufactory at 162 and 164 West 27th street, New York, and possess splendid facilities for executing all orders given them. They have applied their shutters to some of the most prominent buildings in the country, notable among which are several large business houses in the city, one of the most recent being the large iron building at the corner of Union square and 16th street, occupied by Ve J. Magnin, Guérdin & Co., where, by the use of shifting pilasters, the shutters are employed to cover the entire street floor front of the store, forming a complete enclosure.

Suburban Residence.

The elegant and commodious dwelling herewith presented in perspective view and floor plans, needs only to be examined to be appreciated as one of the most skillfully contrived designs ever published. It has been prepared for erection at Nyack, on the Hudson, having on the west a street front, and on the east a river front. The floor plans are shown in reverse.

It is with due reference to the character of the site, the aspect of the building, and the surrounding landscape, as well as to the general taste and requirements of the owner, that the whole design has been adjusted. The aim of the architect has been to produce, at the least possible cost, the most spacious, convenient and symmetrical interior, and the most elegant and imposing exterior, together with thorough and substantial construction.

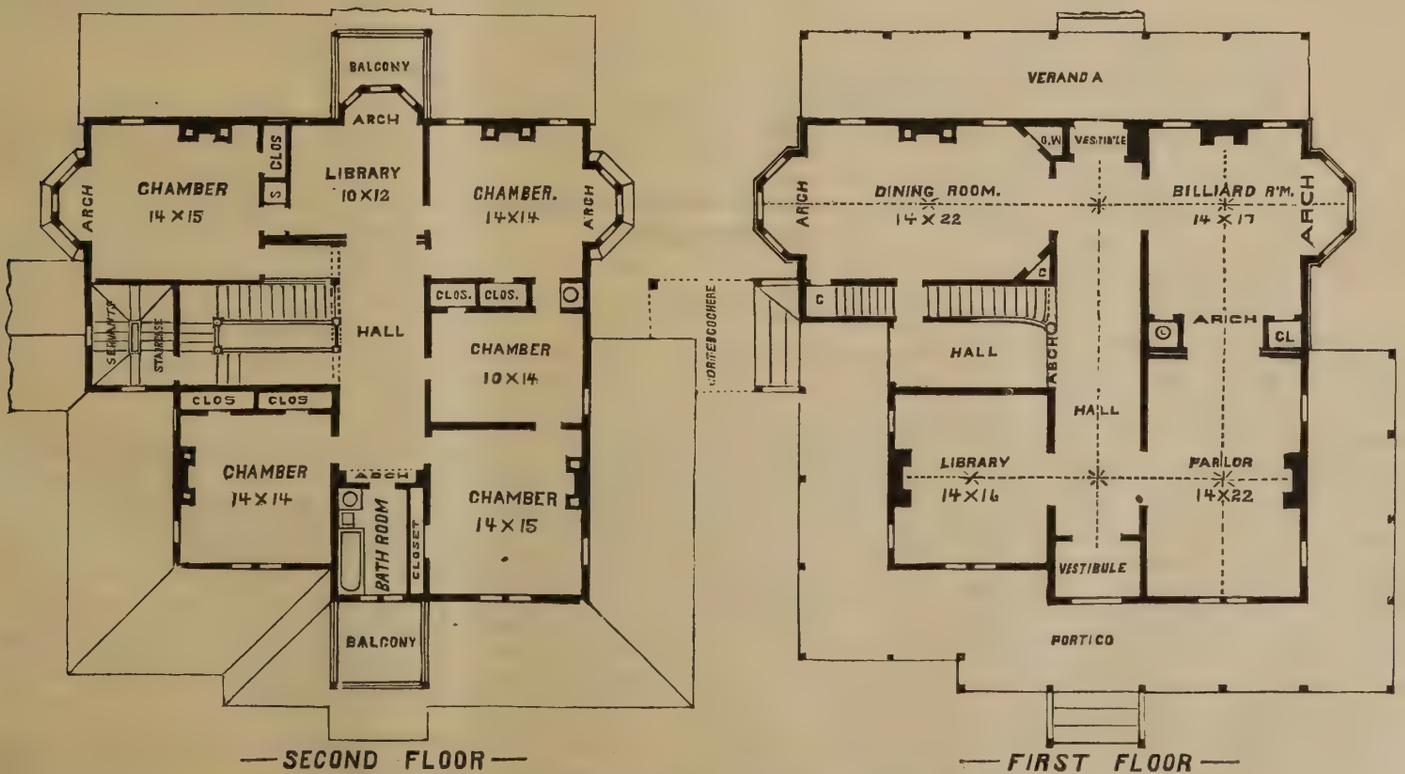
The plan presents almost an unbroken square, yet the eye is gratified with a most pleasing variety of outline and contrast of light and shade. On the south, intersecting with the portico, is a spacious *porte cochere* communicating directly with the transverse hall. From this entrance arises the side tower, which is surmounted by an open belvedere, from which, as the name signifies, a fine view may be had of the charming scenery of the Hudson. An extensive veranda, with turned columns, surrounds the building, except where interrupted by the bay windows of dining and billiard rooms. But let us examine the interior. From the portico we enter the vestibule, an apartment which may be supposed to afford the visitor the first faint glimmering of the character of the internal finish. Here we find that unity of design has been scrupulously regarded, and instead of the ordinary "stock" doors, transverse, moldings, etc., so promiscuously used, we are struck with the artistic harmony which an individuality of design alone can produce. A prevailing error is the idea that poverty of design can take successful refuge behind elaborate molding, carving and gilding: "It is the mind that sees; the outward eyes present the object, but the mind descries." If the mind is offended at the threshold by inconsistent design, though it be trimmed in ostentatious ornament, the impression then and thus produced will hardly leave the spectator when he passes the interior. First impressions are all-powerful in their influence upon the mind, and thus in designing our habitations it is of the first importance that the general outline and proportions—*tout ensemble*—of the building be at once pleasing, and that (if painted) the colors be most tastefully and judiciously selected and contrasted. The same rules apply to the interior, bearing in mind that in the latter case the work comes directly under our closer scrutiny. As the general outline, symmetry and coloring of the building give the spectator his first impression of the exterior, so the finish and effect of the vestibule or hall first impresses his mind agreeably or otherwise as to the character of the interior in general. The full and final adjustment of all the minor and important details of a building properly belongs to the province of the architect who designed it, and if these important mintiæ fall into other and unskilled hands the design must inevitably, in such cases, become distorted in detail, and consequently a failure to both the architect and the person adopting it.

Having thus briefly called attention to the importance of thoroughness in design, we will now resume our examination of the plans before us: Passing through the vestibule doors we enter the main hall, which terminates at the east with a vestibule opening on the river portico. Intersecting the main hall midway is the side transverse hall containing the staircase. This is divided from the main hall by a sequential arch. All the folding doors opening in the halls have sequential heads, as have also those dividing the parlor and billiard room. The dotted lines on the first floor show the symmetrical regularity of the openings and the relative positions of the chimney pieces and gasaliers. Standing under the hall gasalier with the elegant mantles, mirrors and the gasaliers of the parlor and library, or reception room, directly opposite on either side, we can imagine the effect of the glittering and interminable vista. Passing into the parlor we have an uninterrupted view, through the archway, of the billiard room chimney piece. In the partitioned space between the parlor and billiard room, and for the convenience of the latter, is a closet and lavatory. On a line with the folding doors of billiard and dining rooms are the bay windows of the two rooms, producing a grand and spacious effect. The doors and bays are correspondingly arched with sequential arches. Finished off in the dining room are two spacious china closets and a dumb waiter, the latter running to the kitchen. A door from the dining room leads into the side hall, on the opposite side of which is a door leading into the library or reception room, affording a complete circuit of the rooms of the first floor. Under the main flight are the stairs to basement, from opposite the landing of which the servants stairs ascend in the south tower to the attic, the staircase being so arranged that the servants can be readily confined to their own apartments.

On the second floor the same general regularity of arrangement has been as far as practicable observed. The several rooms, which are all of good size, communicate, and are all provided with ample closets. The main staircase extends to the attic where an additional number of fine rooms could be finished.

In construction this villa is of the most thorough and substantial character. A cemented cellar extends under the entire building except the portion devoted to kitchen and laundry. The walls are hard finished and the first story corniced. The frame is covered externally with rough sheathing, felt and weather boarding and the roofs with slates.

The design will meet with wide-spread favor and appreciation, for it will be very difficult, if not absolutely impossible, to obtain from other sources such charming and spacious internal conveniences, and such a beautiful and imposing external effect at so moderate a cost. This villa will cost from $5,000 to $6,000, according to locality and management. The architect, to whom we are indebted for this design, is our well-known contributor, Mr. Horace G. Knapp, whose principal office is at Nyack-on-the-Hudson, N. Y., and whose New York city branch is at 62 West 14th street.



DESIGN FOR SUBURBAN RESIDENCE, COSTING FROM $5,000 TO $6,000.

Prof. Farmer's Views on Electric Light vs. Gas.

Prof. Moses G. Farmer, the well-known electrician, now attached to the Torpedo Station of the United States Navy, was interviewed lately in regard to the expected competition of electric light with gas light. His views have, in our opinion, more weight than those of any other expert in electricity, hence we give an extract from them. He said:

"Speaking of the scare in the gas stock market, it is certainly premature, for at present there are not more than one hundred electric lights in practical use throughout the land, and, compared with the number required for the illumination of the country, they are as nothing. Suppose you wanted to give light to the citizens of New York, each one requiring a light equal to a 10-foot gas-burner. Reckoning on the basis of 1,000,000 people, you would want 10,000,000 candle-lights. If you wanted it divided up into small lights, you could not expect to get more than 500 candles per horse-power, and that would require at least 20,000 horse-power to light the city. In order to accomplish this there would have to be made machines, steam-engines, (to a large extent purposely for it), magneto-electric machines to furnish the electricity, and it would not be advisable to have them average more than 5,000 candles each for fear of getting out of repair. That would require 2,000magneto-electric machines, which could not be produced in a moment. It would perhaps be desirable to have five electric lamps to each machine, and that would require at least 20,000 lamps. While some of the manufacturers are prepared to supply in a certain time their particular style of lamp, the public has not yet decided which is the best to use. No lamp at present in use has such manifest superiority that every person will buy that particular one. None at present in use is properly adapted to minute and profitable subdivision of the electric light. This is an entirely different condition of things from gas illumination. In that factories already exist, and the means of supplying gas-fixtures, tubing, and piping. Gas-pipes are already laid in the streets, which would be utterly worthless for the distribution of electricity for the purposes of electric light, and while competent electrical engineers are sufficiently well acquainted, theoretically and practically, with the distribution of electricity for telegraphic purposes, yet a distinct branch of electrical engineering science needs to be inaugurated and carefully studied before any expensive system of electric distribution should be entered upon; and although I expect to see the electric light widely introduced, and that very soon, yet I do not conceive that it is going to supplant and displace to a very large extent the consumption of gas immediately. But it may, and doubtless will have the effect to stimulate and hasten the use of gas for heating purposes as well as for those of illumination, and so I expect the consumption of gas to increase rather than decrease after the effect of the scare is over. I venture the opinion that in five years from now there will be more gas consumed than there is to-day, proportionately with the increase of the population. One of the effects of the introduction of the electric light for the purpose of illumination, will be to stimulate inventors to produce apparatus for the consumption of gas for heating purposes."

Touching the merits of the electric light, Prof. Farmer said that it would eventually approximate the quality of daylight for the display of goods and merchandise in warehouses. It would be vastly superior to gas for the illumination of workshops and manufactories, for with the same expenditure a better and greater diffusion of light would be obtained. He considered a room fairly lighted that has one candle-light to 125 cubic feet of space, very well lighted with one candle to 75 cubic feet of space, but with the electric light properly distributed it would be easy to have one candle-light to each 40 or 50 cubic feet of space, and this would be accounted a very brilliant illumination. The light, he thought, will render great service in mining regions, lessen the expense, and diminish the dangers. It will render it perfectly feasible to carry on great enterprises by night as well as by day, such as tunnels, bridges, and constructive operations in general, and prove useful for billiard halls, which are lighted with difficulty by gas, and if necessary great agricultural operations could be carried on by night at profitable expense in harvest time. The lighting of streets and other public thoroughfares will be accomplished satisfactorily and at much less expense than the present mode of lighting by gas, and so there would be more illumination for less money; and a good street lamp at night is preferable to a policeman.

With reference to the mode of conducting electricity through the streets, the professor said that copper was the cheapest conductor, and so will be universally used. The best mode of insulating wires underground for conducting electricity for electric illumination, was as yet undeveloped, and will need careful investigation, because the frequent accidents to which subterranean wires are exposed will necessitate the having of a corps of electrical engineers for this special occupation or art, for while it is somewhat of the same character as conducting electricity for telegraphic purposes, still the conditions would be that of another department.

Regarding the cost where power is already in use for manufacturing purposes, and where there is an available surplus and it can be used for the production of the electric light, as at Fall River, Providence, Lowell, Manchester, Nashua, Cohoes, and a number of other places, the electric light can be furnished very much cheaper than gas is at present supplied—perhaps for from one quarter to half the cost. There are two elements that enter into the cost of the electric light—the cost of the power consumed in producing it, which costs only when used, and the cost of interest on the plant, which is as great when not in use, for, like a blister, it draws all night long. So if the light is only to be used for an hour or two, the cost of interest and depreciation might exceed the cost of the power consumed. For instance, the horse-power in some cases could be furnished at $70 per year, while the interest and depreciation on a 5,000-candle machine might cost as much more. So if the light is to be used but a small portion of the time, it would relatively be considerably more expensive than if required to be used all the time. The cotton manufactory would be at one extreme and the coal mine at the other.

In regard to the production of electricity, Prof. Farmer said that an objection is that it cannot be stored up and the store-house drawn upon at pleasure. It must be produced as it is wanted. Finally, he gave it as his opinion that while gas stocks have depreciated in their market value, and may perhaps never return to their former quotations, the gas companies will not cease to pay fair dividends.

New Publications.

Cooking-School Text-Book and Housekeeper's Guide to Cookery and Kitchen Management. By Juliet Corson. New York: Orange Judd Co.

The author of this text-book, so well known among us as the Superintendent of the New York Cooking-School, and author of various good books on cooking, has, by this last publication, filled a real want in the literature of this branch of art, and it is at the present day of book-making, a rare thing if we can say this of a new book making its appearance.

In order to give the reader a clear idea of the aims of the author, it is best to quote a few sentences from the preface: "A book of mere recipes would fail to accomplish the purpose we have in view, that is, some intelligent comprehension on the part of the cook of the chemistry of food and the physiology of nutrition. . . . This knowledge will be available in enabling tyros in the culinary art to realize the imperative necessity for careful study from the very outset of their work, and will assist the more advanced pupils (1) to classify different articles of food in accordance with their effect upon the system; (2) to alter and improve the dietaries of persons following stated pursuits, so as to satisfy their physical and mental wants; (3) to detect adulterations and deteriorations of food. . . . Every cooking lesson should consist of the actual preparation of certain suitable dishes by the pupils; the marketing should be done by them, or in their presence; the kitchen, the fire, and the utensils put in order for the lesson by them," etc. "The prime fact that the sole object of cooking is to prepare food for nourishing the body should never be forgotten. . . . Good cooking should not be regarded as an incentive to gluttony; it has a nobler purpose; . . . its mission is to show how every scrap of untainted food, cheap or costly, can be made to yield all its nutrient properties. . . . Economy in cooking is often miscalled meanness, but a good cook will not waste food any more than a good workman will wantonly ruin his tools or his handiwork."

While recommending this novel text-book most urgently, we predict a continued prosperous career for the enterprise of the talented author.

Harpers' Magazine, Harpers' Bazar, and Harpers' Weekly. New York: Harper & Brothers.

These standard publications always come to us bright, fresh, and readable. Each is replete with charming illustrations and the very highest order of literature.

The *Monthly* has obtained the foremost rank among the standard publications of the day by reason of the superior excellence of all its departments, eminent writers contributing to this end. Its sketches are always good; its stories interesting; its departments of current literature and science full and accurate, while its editorial columns abound in crisp, readable articles on the topics of the day.

The *Bazar* is invaluable for any woman who makes pretension to dress well, and for those who cannot afford to spend much money in this way, there are useful hints given that will enable them to apply what little money they have to the best possible advantage. There is much in the art of dressing, and if women who do not read the *Bazar* would inform themselves from its pages, they could learn that even the cheapest materials can be rendered into attractive apparel by dint of a little skill. The patterns given with each number are always good, and any woman who has any tact at all, with the aid of the descriptions accompanying them, can cut and make her own dresses, producing a garment that will cause envy among her neighbors who rely upon the stereotyped, plain, straight up-and-down dress.

The *Weekly*, with Nast, Reinhart, Sol Eytinge, Winslow Homer, and other artists of equal eminence, always comes to us full of good illustrations, executed in the highest style of the wood-engraver's art, while the letter-press is most excellent. The editorial columns, with George William Curtis at the head, are able and powerful, while the other portions of the reading pages are well conducted.

Popular Science Monthly. New York: D. Appleton & Co.

This magazine was started to meet a want that was felt for a monthly publication that would serve matters of science up in a popular form, and the publishers have not disappointed the public in their efforts to make a journal of this character. A steady growth has marked its history until it has become an actual necessity to all desirous of keeping posted on the progress of science, and any one having a file of this journal possesses a complete compendium of the discoveries made in the scientific world during the period covered by its publication, and that too in a clear, comprehensive form. The most learned scientists contribute to its pages, and under the able conductorship of E. L. and W. J. Youmans the accuracy of the material furnished is placed beyond question. Those who do not relish the dry details of science, will find in this journal the dullness of the most abstract subject discarded and in its place a clear and comprehensive article.

Scribner's Monthly. New York: Scribner & Co.

This journal has steadily risen in public favor since its first number, and the reason is not hard to find. The publishers have been lavish in their expenditures to obtain the best illustrations that the pencil of the artist has been able to produce, and have employed the best writers to contribute to its pages. The result has been to make this popular magazine a conspicuous example of the high perfection of the printer's art. The whole make-up is unexceptional, and we do not know of a more useful journal for the household or library. It is an admirable publication, and we have not read a number that has not been entertaining and interesting. The publishers deserve all the success they have thus far received, and if they continue in their present course, as we have every guarantee they will, they may always rely upon the same cordial support that their journal at present enjoys.

Palliser's Model Homes; Showing a Variety of Model Dwellings. Bridgeport, Conn.: Palliser, Palliser & Co., Architects.

This very neat publication, in addition to some thirty plans and perspective views for various dwellings, also contains a farm-barn and hennery, stable and carriage-house, school, masonic, bank, and library buildings, town-hall, and church, with a large amount of miscellaneous matter, so that we are convinced that it is one of the best books ever offered at the price. We call special attention to it as there are many who sometime during their lives intend to build for themselves a home. This book will enable them to avoid falling into errors in building, and help them to study what their wants really are, so that they will not be heard to say, when it is too late, "If I build again I will not do so and so."

The Columbus Institute for the Preservation of Health and the Cure of Chronic Diseases. By H. A. Hartt, M. D. New York: Russell Brothers.

This publication describes the principles and plans for a new and useful institution which Dr. Hartt proposes to establish in

New York City, and which has been endorsed by all the most eminent physicians and citizens. He bases his theory on the possibility of preventing and curing chronic diseases, gives the plans for the establishment of this institution, and in the last chapter makes a powerful appeal in regard to its necessity. We endorse all his views, including those on medical quacks, wine and alcohol, and wish him success in the enterprise which he so ardently advocates.

Ballou's Monthly. Boston: Thomes & Talbot.

In these days of cheap and demoralizing literature for the young, it is refreshing to get hold of a wholesome magazine that aims to elevate rather than to degrade. A journal of this class we have now before us; it is *Ballou's Monthly*, and we take real pleasure in commending it, not only for the young, but for older people as well. Instead of the trashy articles and stories to be found in other publications aiming to reach the field that this covers, we find within its pages nothing but solid and useful reading matter, which even the most fastidious can peruse with pleasure and profit. The illustrations are fair, while the general get-up of the magazine is attractive. We should like to see this publication in the hands of all families and take the place, among the younger members especially, of that class of literature which is scattered broadcast by several prominent publishers in this city.

The Nursery. Boston: John L. Shorey.

It is a difficult matter to make a magazine interesting to very young children, and to produce such a publication every month requires no little amount of a peculiar kind of talent to render it entertaining. The *Nursery* is a magazine that comes up to our idea of what a periodical for the youngest readers should be, and the publishers deserve praise for their creditable efforts to meet the wants of this class of readers. This publication is a bright and beautiful one, and deserving of a large circulation.

Correspondence.

SUSPENSION PLATFORM.

To the Editor of the Manufacturer and Builder:

I am about to construct a platform 300 feet long by 30 feet wide, of Oregon pine; three stringers to be 10×12 inches; six floor timbers, 3×12 inches; and 3-inch plank for flooring. I should be glad if you would give me your opinion and such information as you may have to offer.

This platform will have no support from below, but will be suspended solely by wire ropes, and for this reason I have to ask what amount of wire rope, and the size, would it require for each side of such a platform. It will not be necessary to use more material than would be actually required, as the platform may be used for four years only. With reference to weight, I consider for timber 40 pounds per cubic foot, and besides on the point loaded cars weighing say 8 tons.

Lima, Peru, Dec. 21, 1878. An Old Subscriber.

Answer to the Above.—Our correspondent does not give all the data necessary to reach a definite answer. He does not give the hight of the central or king post over which the wire ropes have to lay, and from which they descend to the ends of the platform. Therefore we will only make some critical remarks and add some information by which he may be enabled to make his own calculations. In the first place, the platform being 300 feet long, is altogether too long to secure stability with wire ropes going from its extreme ends alone to the top of the king-post, as the sketch adjoined to the writer's letter suggests, which represents a kind of suspension bridge 300 feet long, fixed at one end, and the other extreme end hanging by inclined wire ropes, passing over a vertical king-post at the land side, and fixed to an anchorage some 300 feet back. As the pull of the wire rope is backward at an angle, a larger portion of its strain acts on the platform, compressing it longitudinally, and tending to crush and bend it. A platform of 300 by 30 feet, having a surface of 9,000 feet, will, according to the data furnished, weigh, with its load of 8-ton cars, some 100 tons, if not more. Of this, half is borne by the ground near the king-post, and the other half, or 50 tons, by the wire rope at the flying end of the platform. This support acts under unfavorable conditions, the wire rope being subject to a strain much greater than 50 tons. The amount of this strain is found by multiplying 50 with the cosecant of the angle the rope makes with the horizon; as the cosecant of 90° is=1, the strain is 50×1 tons when the rope is perpendicular; as the cosecant of 45°= $\sqrt{2}$, the strain for 45° is 50× $\sqrt{2}$ tons; as the strain of 30°=2 $\sqrt{5}$, the strain for this angle will be 50×2 $\sqrt{5}$, or 100 $\sqrt{5}$ tons; as the cosecant of 0°, or the horizontal position of the cosecant is infinite, the strain would be expressed by multiplying 50 tons with infinity, which means that no rope could support it at all.

You will clearly see that it will be necessary to support the flying platform at a good many points between the ends, perhaps 20 feet apart, so that 15 wire ropes would be required. For the sake of economy they might vary in thickness, as those near the king-post have much less strain, and this in proportion to the cosecant of the angles they make with the horizon. If 15 ropes at each side have to support 60 tons, it is more than 4 tons for each rope; those nearest to the king-post undergo a strain of say 65 tons, then 70, 80, 100, and so on, while the extreme one, suppose it makes an angle with the horizon of 15°, will undergo a strain of some 1,000 tons. You will easily see that, aside from the difficulties of construction, it will be a very expensive affair, and for the dimensions given, hardly practicable. Remember that when enlarging the dimensions of any structure, whether buildings, bridges, or machines, the expenses increase in a much larger ratio than the cubes of the dimensions, and that beyond a certain limit they become utterly impracticable; while this limit depends on the nature of the structure and the ability and resources of the engineer who plans and executes it.

We trust that the above explanation will be useful to others as well as to our correspondent, hence our detailed answer.

Notes and Queries.

This department is intended to furnish, for the benefit of all our readers, information on any subject of scientific or practical knowledge falling within the field of The Manufacturer and Builder. *All persons possessing additional or more correct information than that which we give relating to the questions, are cordially invited to communicate it to us for publication. We also request that all questions or answers be written on separate pieces of paper, and addressed to the Editor.*

QUESTIONS.

(2257) Japanning Metallic Objects.—I take the liberty of asking you how to japan parlor fire-grates. What is the process for putting it on? Where can I get the japan?—J. D., Victoria, B. C.

(2258) The New Patent Flour.—What is the method by which the new patent flour is made? Please give particulars.—S. J. J., San Jose, Cal.

(2259) School for Mechanical Engineers.—I wish to become a mechanical engineer. Please inform me which you consider the best school for the study of that profession. Bowdoin and Yale colleges have been recommended to me. Is Bowdoin College as good as any?—M. S. H., Knightville, Me.

(2260) Improved Sidewalks.—Please inform me what material I can use to make a composition or concrete sidewalk in our city. Our sidewalks are made of plank; they soon become very bad, therefore, I, as Street Commissioner, would like to get up some improvement.—J. T. R., Helena, Ark.

(2261) Cable Power.—Will you please inform me if there is any work published on cable power and its adaptation for running machinery. If there is, can you supply it, and at what price? If there is none, a little information on this subject would, I have no doubt, be thankfully received by many of your subscribers, especially yours, etc.—W. McF., Clifton, Ontario, Canada.

(2262) Constructing Ice-Houses.—You would confer a great favor on many of your readers by publishing some articles (at least one) on the method of storing ice, so that it will keep. Would a 12-inch sawdust wall be a sufficient protection for 200 tons of ice, if ventilated through the gable of the roof? Are there any rules for ventilation?—R. C. C., Lansing, Mich.

(2263) Do Water-Wheels Run Faster at Night?—A friend of mine who owns a mill informed me a few days since that his mill always runs lighter, in regard to power, at night. As I am not aware of any such logic, will you be good enough to explain if it is so.—R., Providence, R. I.

(2264) Bronzing Plaster Statues.—What is the simplest way to bronze a plaster cast, so as to make it resemble metal?—D. S. J., Potsdam, N. Y.

(2265) How to Mix Plaster.—What is the best way to treat plaster of Paris? By pouring the water over the plaster, or to put the plaster into the water? What should the proportions be?—D. S. J., Potsdam, N. Y.

(2266) Purifying Liquors.—How can I remove the odor of the still, and other disagreeable flavors, from distilled alcoholic liquors?—M. K., Ridgway Pa.

(2267) Hardening Plaster Casts.—What preparation can be used to make plaster casts harder?—D. S. J., Potsdam, N. Y.

(2268) Making Plaster Set Quickly or Slowly.—What addition can I make to plaster to hasten or retard the setting?—D. S. J., Potsdam, N. Y.

(2269) Pyrophorus.—How can I make a powder mixture, which, on opening the bottle containing it, will take fire?—M. T. L., New York City.

(2270) Wasting Heat in Steam-Heating Apparatus.—Will you be kind enough to answer the following question: In a steam-heating apparatus carrying 60 pounds of steam pressure above the atmosphere pressure, the water of condensation is discharged through a common float steam-trap (similar to the Mason trap) into a tank. This tank is open to the air by means of a 2-inch pipe. Now, what is the percentage of loss of heat by the steam which passes out of the air-pipe, supposing the trap to discharge nothing but hot water having a temperature due the pressure? In your judgment, what is the percentage of leakage of these kind of traps?—E. F. O., St. Paul, Minn.

(2271) A Sugar Adulteration Scare.—We look for the Manufacturer and Builder with more than common anxiety, expecting that there will soon be an article about the adulteration of our so-called coffee A sugar. I went to the sugar box and took the scoop to lift some out, and it looked as if it was full of phosphorus. Would good sugar produce the same phenomenon? I did not notice this before, but it being dark on this occasion it attracted my attention, and seeing in the papers articles on the adulteration of sugar in New York, made me notice it particularly. I hope you will soon give us your views on the adulteration of this commodity.—Van P., Iowa City, Iowa.

(2272) Improved Silicate of Soda.—What is the improved process of using silicate of soda in making artificial stone? By using it as a wash or otherwise? When the stone dries it works out in a kind of white mold. What will keep it in the stone? and also render it impervious to water?—H., Essex, Conn.

(2273) Different Qualities of Plaster of Paris.—Is there any difference in calcined plaster, except in the grinding and bolting of it? Am I not right in saying that the finer it is, the firmer it becomes after setting?—H., Essex, Conn.

(2274) Using Condensed Steam for Plating.—Will steam led directly into a kettle of water, render it unclean, or make it unsuitable for using in the plating room? Pure rain water is used for the boiler.—H., Essex, Conn.

(2275) Duties on Sugar.—Can you explain what the recent agitation is about in regard to defrauding the government by artificially coloring sugar? As I do not understand this, please explain.—L. T., Jersey City, N. J.

(2276) Red Indelible Ink.—Is there a red indelible ink suitable for marking clothes? If so, and you know how it is made, please inform me.—G. S., Springfield, Ohio.

REPLIES.

(2257) Japanning Metallic Objects.—The japan varnish is put on with a brush, as is done with all articles that are not coated by being dipped. But the essential point in which japanning differs from ordinary varnishing, is to place the objects covered in an oven or hot chamber called "stove," heated to about 600° Fah., or such a high temperature as can safely be employed without injuring the article or causing the varnish to run off or blister. Metallic articles require no other preparation than cleaning, and if it is desired to have them perfectly black, it is well to give them a preparatory coating of the varnish mixed with fine ivory black, as a simple coating of the japan varnish alone is not black enough, but somewhat transparent. After the objects are coated place them in the "stove" and bake until the varnish is quite hard. You can obtain this varnish at any paint store not behind the age. If there are none of this kind in your neighborhood, you will have to make it yourself. For this purpose you have to proceed as follows: Melt 5 pounds of Naples asphaltum, 1 pound of dark gum anime, pour them into 1½ gallons of linseed oil, and boil for two hours; then melt 1 pound of dark amber resin and boil with 2 pints of linseed oil; add the latter solution to the former, and boil for another two hours, or until a little of the mass, when cooled, can be rolled into pills. Then withdraw it from the fire, and when cold dissolve in spirits of turpentine. The quantity here given is about enough for 3 gallons of turpentine. Some varnishers add a little "dryer," consisting of linseed oil boiled with lead oxid. They put this into the linseed oil with which the asphaltum is boiled. The advantage of this addition is that it considerably shortens the time during which the objects have to be baked in the "stove."

(2258) The New Patent Flour.—In order to make this understood we have to state the usual process of making the different qualities of flour. The best qualities used to be made of winter wheat. Spring wheat yielded either much less in quantity, or else so much of the bran got into the flour in its manufacture that its color was intolerably dark. The wheat would be ground and then bolted. In the refuse—the bran and middlings—would be included a large proportion of the weight of the spring wheat, and this would sell more particularly as feed for horses. Now the best brands of flour, and the most expensive, are made of this very refuse of the old-fashioned process. It all came from the discovery of a way to draw out the bran. Under the new process the wheat is ground about as before. The first result is an ordinary flour, sold for exportation; then the remainder is taken and put upon great horizontal sieves, and while agitation is going on there, an ingenious system of draft is rushing up through, and carries off the bran. What is left is the glutinous portion of the wheat, the most nutritious and the most productive, and out of this, purified now by the drawing off of the bran, we get our new-process flour. The result of this invention has been to make the poor spring wheat of Minnesota and upper Wisconsin the most valuable kinds of grain. A French savant has said that the inventor of a new kind of food was greater than the discoverer of a new star; we endorse this fully, and think the invention here explained is of far more importance to mankind than the discovery of Neptune and Vulcan, with the moons of Mars thrown in.

(2259) School for Mechanical Engineers.—Without reflecting on the value of other schools intended for the study of this profession, we consider the Stevens Institute at Hoboken, N. J., equal, if not superior, to any other. We have good reasons for this opinion. The Bowdoin College is very good, so is Yale, as is also the Rensselaer Polytechnic Institute of Troy, N. Y., and some others we could name.

(2260) Improved Sidewalks.—The greater or lesser degree of perfection in sidewalks is merely a matter of cost, provided the money is judiciously expended in every case. Much money may be spent on inferior articles, such as the poultices made of coal tar, called asphaltum, or concretes, which are too soft or insufficiently water-proof; both are to be condemned. If you want an asphaltum sikewalk, take the natural asphaltum from Val de Travers, Switzerland; such a material or its equivalent was introduced more than forty years ago in Paris,

Brussels, and Amsterdam, and has given perfect satisfaction. It is like stone, but is practically equivalent to a stone which softens by heat, and in its plastic state may be given any shape and is easily applied on the ground, provided however that you make a good level sub-road for its support, concrete being the best for this purpose, but in this case the concrete need not be of a superior quality, as the asphaltum layer over the top being hard and water-proof, protects it. Such a pavement is perfectly water-tight, and prevents any moisture from soaking through. This, however, is not the case with concrete pavements, which may be as water-proof as brick, but are not water-tight, as they absorb moisture like brick. Some kinds of concretes, however, do not absorb water as readily as brick, but none are absolutely water-tight. If you conclude to use concrete, which is always cheaper than good asphaltum, use one with Portland cement, which is the basis of all good concretes. One barrel of such cement to four or six of sharp sand, makes as good a pavement as any of the patented artificial stones recommended for this purpose. We have, in front of our office, between the Post Office and the City Hall in this city, samples of both the pavements referred to above. A sidewalk of Swiss asphaltum is now being laid along the northern front of the Post Office, while the sidewalks around and through the City Hall Park are paved with a patent artificial stone of which Portland cement is the principal ingredient. The latter has now been laid for several years and keeps in excellent condition, which is a great recommendation, considering the immense amount of wear and tear to which it is submitted in this central location or focus of the busiest city of the New World.

(2261) Cable Power.—As there is no such thing as a cable power, we suppose you mean the transmission of power by means of cables in place of belts. Wire cables are successfully employed where it is desired to transmit power through great distances, especially when the transmitter has to pass over an unprotected route and is exposed to the weather. A belt under such circumstances would soon be spoiled, and also become alternately too slack or too tight by alternate rainy and dry weather; in such cases a wire rope is advisable. As a general rule, wire ropes should travel much faster than belts; and it should be remembered that the power which such a rope can transmit is in a direct ratio to the velocity with which it moves, also that its diameter is inversely proportional to the square root of its velocity—that means, that if running at four times the former velocity the cable needs only to have half the diameter. There are various places in our large cities where you can obtain cables suitable for such purposes. Of course the pulleys have to be made to fit the cables, and their relative size is a matter of importance, in regard to which an able engineer can give the required data after he has been made acquainted with the state of affairs and the conditions which have to be fulfilled.

(2262) Constructing Ice-Houses.—It is scarcely necessary to publish articles on ice-houses, as they may be constructed in a variety of ways, and will always be successful provided the following conditions are complied with: 1st. The form should be as nearly similar to a cube as is convenient in regard to size, because a cube has, relative to bulk, the least amount of exterior surface exposed, and the latter must be as small as possible; only when very large, this form may be objectionable for the practical handling of the ice, and then a building of greater length than width or hight may be preferable. 2d. The sides should be built of boards, tightly joined, and double, with a space between of some 12 inches wide, and loosely filled with a non-conducting material, such as perfectly dry sawdust or its equivalent, so as to shut off the circulation of the air between the double walls, which circulation, if it is allowed, causes heat to be conveyed from the outer to the inner wall. 3d. The roof should be double, and free ventilation provided for between the two coverings, as the sun shining on the upper roof soon makes it very hot and will slowly heat any filling between and conduct the heat downward. A good plan is to have one or more ventilators on the highest part of the upper roof, and openings around its lower part, so that the heated air between the two roofs, which is bound to ascend, may find an exit above and be replaced with cold air below. 4th. There should be no other ventilation except between the two roofs. The ice itself needs no ventilation; on the contrary, ventilation only tends to melt it rapidly, and any air currents should be carefully excluded. If there is a ventilating opening near the roof, as you propose, an air current will enter there every time the door below is opened, and by the downward tendency of the cold air cause an exit of cold air below, resulting in an immediate rise of temperature inside. 5th. There should be only one door, and if there are more in a large ice-house only one should be opened at a time, so as to avoid air currents. If the ice-house is high, it is well to have the door or doors as high as the side walls, and so arranged that a section only can be opened at a time, as it is essential to open only the upper portion when the ice-house is full, or nearly full, and to avoid the opening of the lower portions of the doors as long as possible. 6th. The door should be double, like the walls, and it is advisable to have the joints closed by weather strips. 7th. A most important feature is to give exit to the water below, so that the lower layer of ice is kept dry, when, by the melting of the upper layers, water drops down between the blocks, which should be separated by sawdust or hay, as otherwise they will all freeze together in a single mass. The exit for the water should be provided with a trap, so that no air can escape, but water only.

(2263) Do Water-Wheels Run Faster at Night?—This is an old notion, on which we have given our opinion before. The assertion that water-wheels, and the machinery driven by them, run faster at night, is simply an illusion, produced by the contrast of the motion of ponderous objects with the stillness surrounding us at night. We long ago took the trouble to time the number of revolutions of water-wheels, and to make some other comparative tests in regard to their effects, and we satisfied ourselves that there is actually no difference whatever, and that the different impressions made on us at night compared with those made during the busy hours of the day, is positively illusive. Logically considered, there cannot possibly be any sound reason for the asserted difference, and theory agrees with practice.

(2264) Bronzing Plaster Statues.—Bronze powder is dusted over the statue while it is yet sticky from a coating of turpentine varnish. The best way is first to give a few coats of alcoholic shellac varnish, and then the coating of turpentine varnish, as otherwise the latter is too quickly absorbed. Let it stand till half dry and sticky, and then dust over any color of bronze powder to suit the taste.

(2265) How to Mix Plaster.—As the qualities of plaster differ, depending on their nature and the degree of burning the plaster has undergone, definite proportions are not to be depended upon; hence the result of the mixing must be taken as a guide. The best way, and that followed by those who make plaster casting a business, is to pour the water first into the dish used, then to sprinkle in the plaster gradually, so as to cause all of it to come in contact with the water. Take care to have plenty of water, and to pour off the superfluous water; then stir carefully and pour without delay, as it soon hardens.

(2266) Purifying Liquors.—One method is to dilute the alcohol and filter it through charcoal, and then distil it over again. If it is not diluted the charcoal will not remove the flavor. Another method is to shake up the diluted liquor with the charcoal; let it settle, and drain off, then distil again. To remove the fusil oil flavor, 7 ounces of the following mixture is recommended for 2 gallons of the undiluted liquor: 150 parts of albumen, 30 of starch, and 15 of milk-sugar, well mixed together. This is shaken up in the liquor, and after settling the clear liquor is drawn off again.

(2267) Hardening Plaster Casts.—You may soak them in a solution of alum, or a warm and diluted solution of glue, until well saturated; the latter makes them very tough when dry. Or you may soak them in hot melted paraffin; in this case the plaster becomes adapted to be cut and turned in a lathe. Another method, but not so effective, as it makes the plaster harder without being stronger, is to mix it with sharp sand, or, what is better, with pulverized pumice stone. Such plaster is very well adapted to make molds for casting easily fusible metals.

(2268) Making Plaster Set Quickly or Slowly.—In order to make plaster set quickly, mix it with warm water into which a little sulphate of potash has been dissolved. To make it set slowly, mix it with fine slacked lime. The time of setting may be regulated by changing the relative quantities.

(2269) Pyrophorus.—There are several such mixtures known to chemists. One of them is called after its inventor—Homburg's Pyrophorus. It is easy to make, and perhaps the most reliable. It is made by combining (by heat) a mixture of dry white sugar and alum in an open pan; then it is introduced into a small flask of hard glass, and heated to a red heat, the free access of air being avoided by a loose stopper. It is then closed tight by a cork, when, any time afterward, it will take fire on being opened and the contents exposed to the air. The acting elements are the finely divided sulphid of potassium and carbon. Another pyrophorus is made still easier by putting tartrate of lead in a test-tube, closing it up loosely with paper, and heating over a spirit-lamp; when the vapors passing through the loose stopper have ceased, it is closed by a well-fitting cork, and laid aside to cool. Afterward, when it is opened and some of the contents poured out in the air, they will take fire and burn like fire-works. The nature of this pyrophorus is that it consists in very finely divided carbon and metallic lead, the carbon, generated by the destruction of the tartaric acid, which is rich in carbon, reduces the oxid of lead to the metallic state, and this in a very finely divided condition, while the excess of carbon remains with it, also finely divided—so fine, indeed, that it offers such a large surface to the oxidizing action of the air that the oxidation of the lead, which otherwise acts slowly, acts so rapidly as to heat it to the temperature of ignition of the carbon. Even iron may be so finely divided that it will take fire in the same way.

(2270) Wasting Heat in Steam-Heating Apparatus.—You can easily measure the amount of heat wasted by discharged hot water by means of its amount, and its temperature above that of the feed-water. In order to measure the amount of heat lost by escaping steam, you let it escape in a measured amount of cold water, and notice its rise of temperature in say 10 minutes. We will illustrate this by an example: Suppose that every 10 minutes 20 pints of water of 200° escape, while the temperature of the feed-water is 60°; you lose then by this leakage of heat $(200-60)\times 20$, or 2,800 units of heat, or 16,800 units of heat per hour. Suppose the steam escaping when passed through a barrel containing 300 pounds of water at 60°, will heat this in 10 minutes to 80°, you have an increase of 20° for 300 pounds, or 20×300, that is 6,000 units of heat for 10 minutes, or 36,000 units per hour. The loss of heat in water running away amounts then to 16,800 units, in the steam escaping to 36,000 units, together 52,800 units of heat per hour, or 880 units per minute. In order to realize the amount of this loss, consider that one unit is 772 foot-pounds, therefore 880 units represent 679,360 foot-pounds, and as one horse-power is 33,000 foot-pounds, you lose 20 horse-power, or an amount of fuel theoretically equivalent to 20 horse-power; this amounts to nearly 20 pounds of coal per hour. Or you may in a shorter way reach this result by considering that the combustion of one pound of coal is theoretically equal to 13,000 units, but in practice only equal to about one-quarter of this, or 3,250 units; as you lose by escaping steam and hot water 52,800 units per hour, you lose $20\times 3{,}250$ almost, also equivalent to 20 pounds of coal. On re-reading your letter, we understand you to mean to say that you have no hot-water discharge from the tank, but only from the trap into the tank, and that your only loss of heat is from the air-pipe discharging steam from the hot tank, and radiation from the same. However, the above explanation will show you how to find the loss of heat by the steam, to which must be added the possible cooling by radiation of the tank. If you feed the boiler with this water, you recover some of the heat, but the heat escaping with the steam is an absolute loss.

(2271) A Sugar Adulteration Scare.—It appears that you are not aware that when pieces of white and dry pure sugar are rubbed together in the dark, electricity is developed, and visible by a phosphorescent glow. The same is the case with a barrel containing pure dry sugar when it is shaken up, or the sugar rubbed by taking some of it out with a scoop. It is by no means a sign of adulteration, but rather the contrary, as the purest cane sugar behaves in this way, while when adulterated with inferior kinds of sugar, such as glucose or grape sugar, it does not show this phenomenon; neither does impure brown sugar exhibit it. The idea that phosphorus should have been used for adulteration is absurd, as it has an abominable taste and smell, could do no good for any purpose whatsoever, and costs more than sugar—in fact, about ten times as much. This is a point often overlooked by those afraid of adulterations. Thus some books speak of the adulteration of cane sugar with milk sugar, which is less sweet; this may be done in some regions of Southern Germany or Switzerland, where milk sugar is a home product and made on a large scale, while cane sugar is an article of expensive importation; but in this country, where cane sugar is abundant and cheap, while milk sugar is scarce and dear, it is out of the question. The contrary might be the case; milk sugar may with profit be adulterated with cane sugar, in the same way as maple sugar is adulterated with cane sugar and with the cheaper grape sugar, while the maple syrup sold in cans or bottles is almost always largely adulterated with syrup, or with the cheaper glucose. For further information, we refer to an article on the adulteration of sugar in another part of this number.

(2272) Improved Silicate of Soda.—The defect of the ordinary silicate of soda, is that it contains too much potash or soda, and too little silica. This is the cause of the white stuff continually working out. In order to make a better article the quantity of soda fused with the silica should be so small as to make the product very insoluble, even in boiling water. The usual way is to take 15 parts of pulverized quartz, 10 of potash, and 1 of powdered charcoal, well mixed and fused in a fire-proof melting-pot for some six hours. The product is pulverized and boiled in water for some four hours until dissolved, and the solution concentrated by evaporation. A better way is to use pulverized flint, and treat it with a strong soda or potash lye, contained in a *closed boiler under a pressure of* 8 *atmospheres*. Infusorial earth would be best, especially that from Nevada, which is sold here as a polishing powder under the name of Electro-silicon. It consists of microscopic shells of pure silex; 120 parts of silicious earth is treated with 75 parts of caustic soda and about 200 of water; from this 240 parts of gelatinous water-glass may be obtained. A silicate of soda which contains as much silex as possible will behave better than the common kinds which are made by boiling without pressure, and contain an excess of soda.

(2273) Different Qualities of Plaster of Paris.—The various qualities of plaster depend chiefly on the raw material—the purity of the gypsum from which it is made. The best plaster can be made from alabaster; of course a superior degree of fineness obtained by grinding and bolting is advantageous; but plaster made from poor material, or good material submitted to improper burning, cannot be made good by the most refined grinding and bolting.

(2274) Using Condensed Steam for Plating.—We see little objection to the use of steam in this way, as we know of its use for similar purposes. However, you must find out whether the steam carries iron with it from the pipes; if so, it might interfere with the proper and pure condition of the solutions.

(2275) Duties on Sugar.—Our article in this number, entitled "The Sugar Question," will give you the desired light on this subject.

(2276) Red Indelible Ink.—We find it recommended to take the white of an egg and mix with water, (equal parts of each), beat it to a froth, and filter through linen. Mix in fine vermilion so as to make a thick liqnid; write with a quill pen, and when dry fix it to the cloth by pressing it on the back with a hot iron. It is claimed that such writing will not be attacked by soap, alkalies, or soda, and that the ink will keep in well closed bottles.

THE MANUFACTURER AND BUILDER.

Vol. XI.—No. 2. FEBRUARY, 1879. ELEVENTH YEAR.

Fuel and Labor Saving Devices.

The adjoined illustration, representing a section of a part of the sugar house of the Brooklyn Sugar Refining Company, foot of South Second street, Brooklyn, N. Y., is given for the purpose of explaining a few very economical arrangements, devised by Mr. Thomas Gaunt, M. E., of New York, and intended to save fuel and labor.

It is easily understood why both fuel and wages are the most expensive items in most manufacturing establishments, because they are constantly recurring, hence an outlay of fifteen or more times the amount of such expenses saved is justifiable in an economical point of view. Suppose, for instance, that an arrangement is devised such as we described last month, (page 1), by which at least half a ton of coal per day is saved, it amounts to a saving of some $500 per year, which, at the rate of 6 per cent, is the interest on a capital of $8,500. To spend a few thousand dollars for the purpose of effecting this saving, is not only profitable to the parties interested, but is to be recommended on the general moral principle that intelligent man should avoid unnecessary waste of whatever material is consumed.

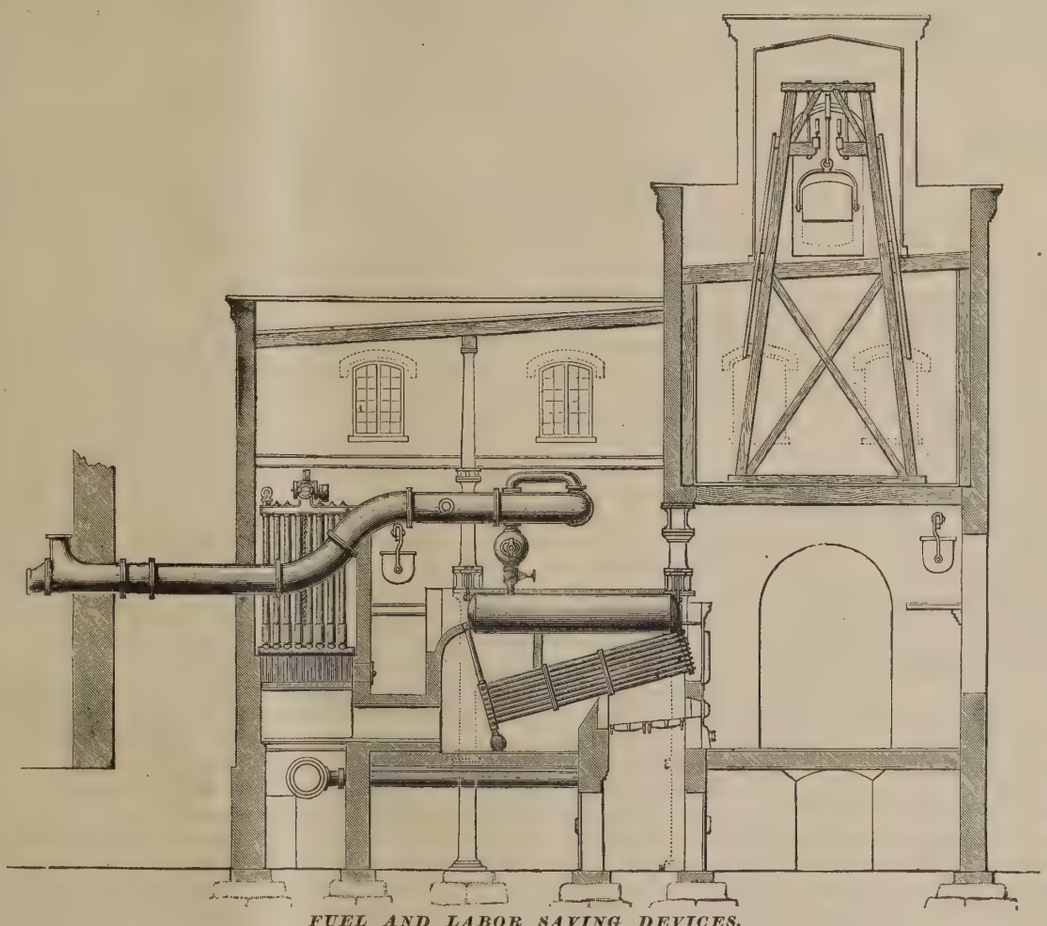
It is the same in regard to labor; if a mechanical contrivance can do away with the labor of one man, who is earning only $1 a day, it will effect a saving of $300 per year, which, at the rate of 6 per cent, is the interest on $5,000, hence in such a case an expenditure of $1,000, $2,000 or $3,000 effecting a saving of this kind, is profitable.

In the center of our illustration, the inclined bundle of tubes represent one of Babcock & Wilcox's excellent and economical tubulous boilers; 1,000 horse-power of these boilers furnish steam at present for the refinery above mentioned, but foundations are already laid for double that amount. The heat of the fire first passes upward over the fire-bridge, (seen half way the tubes), and then downward to the flue, at the left. Before ascending to the chimney, it passes through a chamber containing a series of vertical tubes, through which the feed-water for the boiler passes, seen in this engraving behind the main steam-duct, and on page 1 of our January number on an enlarged scale, so that the feed-water, before entering the boiler, is heated to almost the same temperature it has in the boiler itself. For further details we refer to page 1.

In regard to the labor saved in the sugar refinery mentioned, we call attention to the right-hand side on top of the adjoined engraving. From the top of this elevation an inclined railroad runs down to the dock, projecting over the coal-boat lying at the end of it. On this railroad runs a small car, on which the coal-bunk is suspended, which thus hangs between and below the rails. By its own gravity it runs to the dock, where a single workman, sitting in a comfortable office near a stove, manages all, and accomplishes alone the work of two or three hard-working men, and in fact of six or ten if the coal had to be transported on wheel-barrows. When the car has arrived at the end of the track, he causes it to descend into the hold of the boat, where it is filled; when full, he pulls a chain, which shifts the belt in the building, hoists the coal-bunk, suspending it to the car, when the car is pulled up the incline into the building, where, arrived at its destination, it rings a bell, which is the signal to dump the coal. The latter is done by pulling another chain, then the empty bunk and car return by their gravity to the end of the dock, and the same operation is repeated.

The coal in the building is stored over the boilers, while shutes convey it to the front of the furnaces. By the use of proper valves the amount of coal coming down is regulated, so that cartage of the coal is entirely done away with, and the firemen always find the necessary coal just in front of their fires.

The very same device is used for disposing of the ashes. It will be seen that there is a basement extending under the whole boiler-room, and that the ash-pit extends into this basement. Dumping dead-plates admit of all refuse from the fire being discharged directly into this ash-pit without any dust or heat in the fire-room. This continues until a cargo of ashes is ready for shipment, when the car is lowered in the building until it reaches the large storage-room below the boilers, where it is filled, hoisted up, carried by its own weight down the inclined railroad to the dock, and there lowered and dumped into the boat intended to convey it to the dumping ground.



FUEL AND LABOR SAVING DEVICES.

Another little device we must mention. It is that used to convey coal from one end of the building to the other; at the extreme right-hand side, half way up the main building, a small coal-bucket is seen suspended; it hangs on a circular railway, which goes round the building and conducts the chain to the other side, where it is needed to feed the furnaces intended to revive the bone-black; it is seen at the left, next to the chamber containing the vertical tubes referred to, intended to heat the feed-water. The heavy tube seen over it conducts the steam from the boiler-house to the sugar-house, of which only a small portion of the wall is seen at the extreme left of the figure.

Electricity Turned on Like Gas, Water or Steam.

It may not be economical to transmit powerful electric currents to great distances, but it appears to be practical to distribute them for use within the radius of a mile, so that instead of having an expensive apparatus for generating the electricity in each house, any one within the radius of that mile may have the electricity furnished as easily as water, gas, or steam. At present the prospect of being able to turn on electricity in our houses seems favorable. This would be especially valuable for photographers, who cannot work at all by any other artificial light, and in this way

they may be furnished during the evenings with an available light, perhaps at a less expense than that in the London photographic gallery of Mr. H. Van der Weyde, where separate machinery is employed to furnish the required electric currents for the exclusive use of that establishment.

The Manufacturer and Builder.

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This journal has the largest circulation of any mechanical monthly published in the United States. Its value as an advertising medium is therefore apparent.

Vol. XI. No. 2. ELEVENTH YEAR.

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The Special Edition of our March Number.

As previously announced to our readers and advertising patrons, we intend mailing eleven thousand copies of the March number of the MANUFACTURER AND BUILDER to the principal SAW and PLANING MILLS in the United States and throughout the Dominion of Canada.

In repeating this important announcement, we desire again to direct the attention of advertisers to the immense value of this large extra circulation, as offering a rare and splendid opportunity for reaching a field which we think it safe to say has not been covered—at least so completely through any other channel. Our addresses have been compiled with much labor and care from the most reliable sources, and the result is as complete a list as it is possible to obtain of these two special industries.

A large amount of space in the March number has already been disposed of, and those wishing particular locations should advise us without delay, so that satisfactory positions may be secured.

As the rates for advertising are the same as for our regular edition, the benefit of a large extra circulation is had at comparatively slight cost.

We trust that advertisers who have not already given us their cards for this special issue will favor us with the same, and we request that orders be sent in as early in the present month as possible.

The Sugar Question.

CONTINUED FROM PAGES 2 AND 3.

We have been placed in possession of some reliable statistics in regard to the interest of the laboring and middle classes of our country in this important industry. The number of laboring men directly engaged in the refining business is 10,000, while those who are indirectly engaged in supplying the necessities required by the sugar refineries number 40,000: among the latter are 5,000 coopers, 20,000 stave trimmers, lumber cutters, and hoop-makers in Michigan, Ohio, and Indiana; 2,000 machine-makers and engineers, besides wagon-builders, carters, blacksmiths, masons, brick-layers, and many other trades of which many members make their living from the refineries, so that the total number may be set down at 50,000, who have at least 100,000 women and children dependent upon them. The earnings of these men amount to $500 a year on an average, so that the total sum paid out to them in cash is $25,000,000 per year, of which they, as laboring men, living mostly from hand to mouth, spend nearly all to provide for the necessities of life, and therefore circulate this amount yearly among grocers, bakers, dry-goods stores, etc.

These statistics alone show the wisdom of a policy which will sustain the present laws, as under their operation a great, profitable, and generally beneficial industry has grown up; it makes it clear how unwise it would be to adopt another policy urged upon by interested parties, who do not care in the least for the welfare of this branch of industry, or of those interested in it, but who would break it down, regardless of the cost and ruination it would bring to thousands, if they could only accomplish their selfish purposes, which is monetary gain for themselves at the cost of the life-bread of thousands. Therefore we appeal to those in power with the old saying, "Let well enough alone."

The duties on sugar, as they now exist, and to which we referred on page 3, are, for Melados, concentrated cane juice, tank bottom, 1½ cents; for sugars below those classified after the accepted Dutch standard as No. 7, and which are the low Bahia, Manilla, East India dry, and Cuba molasses sugars, 1¾ cents; from 7 to 10, 2 cents; from 10 to 13, 2¼ cents; from 13 to 16, 2¾ cents; above this are sugars from Cuba and Demerara, on which the duty is 3 cents per pound, or more, according to quality; refined sugars pay 4 cents, to all of which 25 per cent duty is added.

It is evident that if this tariff were changed in such a way as to equalize the duties, the lower grades would no longer be imported, but only high grades and refined sugars; the refineries would be closed up, and the sugar now cheap would at once become dearer, so that even the consumer would be loser as well as the manufacturers, who would be utterly ruined.

Past experience has already proved what we have here asserted. In 1870 the rate of duty on all sugars below No. 13 was 3 cents; the imports were nearly 93,000,000 pounds, employing 80,000 tons of American shipping, while in 1877, when these low grades paid according to a scale in which their value was considered, the amount imported was nearly 223,000,000 pounds, employing 155,000 tons of American shipping. During the last ten years the price of raw sugars has fallen from 11 to 8¼ cents, and of refined A sugar from 15 to 10 cents, which shows that by improvements in our refining processes we have reduced the cost of refining from 4 cents in 1868 to 1½ cents in 1878, so that now we can beat the world in cheapness and perfection of the refining business.

It is interesting to state in this connection that the sugar refining appliances sent by the French government, with experts in that business, to our Centennial Exhibition at Philadelphia, were found and acknowledged by themselves not to be equal in skill and economy to what was shown them in the best refineries in the United States.

In regard to the pretended adulteration with grape sugar, it is true that at present grape sugar, which is quite white, is made from Indian meal; but as one of its chief qualities is to be uncrystallizable, it cannot be used in white crystallized sugar, so if any one buys this there is a certainty of getting a pure article. But at any rate such an adulteration is harmless, and in justice to the refiners it should be stated that its formation during the process of refining cannot be avoided; as soon as a solution of sugar is diluted an incipient fermentation takes place, of which the first step is the formation of glucose or grape sugar from the cane sugar. Now this dilution is necessary in some stages of the process, namely, when the charcoal filters are washed out; the sugar thus obtained cannot be thrown away, as this would be ruinously wasteful. Here it is that a natural contamination with grape sugar takes place, without intention of adulteration. The sugar thus saved enters into the lower grades.

In regard to the impurities found in the samples of sugar sent to the Board of Health for examination, as mentioned at the close of our article on sugar adulteration on page 3, and in which tin and an acid were found, we wish to remark that as these samples had been for many months previous in the hands of enemies of the sugar refiners, the test proves nothing. In order that justice may be done, sugar should be procured at the refineries by a third, neutral party, and be of the same quality as that sold to the trade. Only an analysis of sugar thus procured can have any weight in a legal point of view. We have no doubt that the refiners will vindicate themselves.

A Million-Franc Telescope at Last.

A step toward the fulfillment of our proposition, made several years ago in this journal and elsewhere, to build a million-dollar telescope, is now being taken in France. M. Camelle Flammarion, of Paris, has recently published a number of articles to prove that, after all, there may be organic life on the moon, and even inhabitants. He has organized a committee to collect the necessary funds to construct a refractory telescope of sufficient power to settle this question definitely. The cost of the instrument is calculated at one million francs, or two hundred thousand dollars.

When some years ago we proposed, at the yearly meeting of the American Association for the Advancement of Science, that our astronomers should recommend the construction of a million-dollar telescope, to be built by the united efforts of the government and of capitalists, we were laughed at, and some of our astronomers present at that meeting said that it was ridiculous to talk of a telescope costing more than $20,000 or $30,000. What do they say now, when the Parisians are going to build one costing $200,000, after we have one at Washington costing $50,000, and worth all that? At that time we wrote to Mr. Alvin Clark, of Cambridge, Mass., who made the Washington $50,000 telescope, and he by no means laughed at the idea, but thought it feasible, requiring however great care and the labor of several years.

As in the lower strata of our damp atmosphere near the sea-shore there are so very few favorable nights for observation, we proposed to place the telescope in the interior of our continent, far from the ocean, on one of the most suitable peaks of the Rocky Mountains, say Pike's Peak, where there is already a meteorological observatory. Mr. Clark's answer to this proposition was, that in that case it would be best to erect a workshop there, so as to construct the largest and most fragile parts of the telescope, especially the objective, on the spot where it was to be erected, so as to avoid the dangers incident to transportation. Very

likely other peaks are now known, of a less extreme altitude than Pike's Peak, where the winters would be less severe, and the work not so long interrupted during the cold season, as it would be on Pike's Peak.

It is certain that the French telescope will not be erected in Paris, but probably at a great elevation, the Puy de Dome for instance, a mountain renowned among scientists; as barometric observations, intended to prove the influence of elevation upon the mercurial column, were taken there as long as a century ago. We hope that there is now a meteorological station on this mountain—if not, there ought to be—and let us hope soon an astronomical observatory, with the great million-franc telescope.

Tea and its Adulterations.

The difference in the taste and color of various teas is due to the mode of preparation as well as to the nature of the plant from which it is derived. If the leaves are quickly dried in copper pans, they retain more or less of their green color, not because any copper is dissolved in them, but because by drying in iron pans the color would be spoiled, the iron forming, with the astringent principle in the tea, (tannin), a black color—in fact, ink. Those kinds of tea to which, in this way, no good green color can be communicated, are made into black teas. The leaves for the latter are chiefly derived from plants growing in the colder mountain regions, having a more hardy character than the tea-plants growing in the well fertilized plains and valleys. The leaves of the mountain tea-plant are, with their natural moisture, first put into heaps, and left to a kind of fermentation for some twelve hours, and the heaps are tossed about by hand until the leaves become uniformly dark, when they are roasted in iron pans over a slow fire; they are again rolled about, and finally dried over a hotter charcoal fire. The teas thus prepared are the Oolong, Souching, Pekoe, Congou, etc., either of which, by ignorant dealers, have very inappropriately been called English breakfast tea, and are now, as such, known among us. Some of these teas, such as Oolong, if dried at once after being picked, would be green. This is the case with Japan tea, which is derived from a plant of the class from which the Chinese make their black teas; but it is not subjected to fermentation by letting it lie in heaps—it is dried at once after being picked. In taste and general behavior it is equivalent to good black tea; however the leaves have a green color, but are quite different in all other qualities from the green Chinese teas.

The green teas are Gunpowder, Imperial, Hyson, Young Hyson, and Twankay. By drying the leaves while fresh they retain a light greenish shade, sometimes the yellow color of dead leaves. Unfortunately people will not buy tea of this color, and in order to improve the looks of such leaves and make them more salable, coloring matters are often introduced. These coloring matters contain positively no copper from the copper pans in which the tea has been dried, as the most scrutinous chemical analysis cannot detect any copper in them; but what is found is yellow organic coloring matter, such as turmeric, yellow extract of willow bark, etc., which, by the addition of a very small quantity of Prussian blue, makes a good green. This coloring matter is brought to a pulverulent condition by mixing fine China clay with it, and the leaves, when they are still a little moist, are mixed with the greenish dust, which adheres to them and causes the improved appearance. The microscope shows that this coloring matter covers the leaves very irregularly, while the amount is found to be one per cent, and in the cheap qualities of green tea as much as three per cent. By shaking the tea, some of it separates, and can be easily sifted out.

The hue and cry now raised in some papers about the deadly poison contained in this coloring matter, namely, Prussian blue, which is a compound containing Prussic acid, is all nonsense. The amount which the most inveterate tea-drinker gets into his system is scarcely to the appreciated, as it only presents a quantity equal to a small fraction of one per cent. In such a small quantity it is harmless, and, on the contrary, acts as a tonic, being often prescribed by physicians. Dr. Henry A. Mott, who lately made an analysis of various green teas, and published the results, expresses the same opinion. He found among the samples, which were bought at different retail stores, the Japanese teas the purest, and among the green teas the cheapest Hysons contained the most coloring matter.

A Warning to Plumbers and their Patrons.

Diphtheria, scarlet fever, and pneumonia have been particularly active in certain parts of New York and Brooklyn during the past year, and the cause is criminal carelessness, official stupidity, and extraordinary recklessness on the part of property owners, and of builders and plumbers. Although the life of a person in ordinary circumstances is of as much value as the life of a millionaire, it is quite natural that the latter, dying in a costly mansion where money has been lavished on devices for protection and comfort, should attract the greater attention, especially if it were a reasonable inference that sewer-gas was in any degree a predisposing cause. Fortunately the death of the late Mr. Rockwell, in Brooklyn, was brought to the notice of the authorities, and the result of an official investigation is most surprising.

On Brooklyn Hights live many of the wealthiest and oldest families in Brooklyn. Furman street runs along the river front, and is on low ground, occupied mainly by warehouses, car tracks, and cheap tenements. On the hights above it, and adjoining other streets, are located the homes of wealthy families, the principal churches, also the principal young ladies' seminary, formerly the Female Academy, now called the Packer Institute. In this district a great number of children and not a few adults have been carried off by scarlet fever, diphtheria, and pneumonia. When Mr. Rockwell's family began to die, and one after another was carried to Greenwood, public attention was attracted to the several possible causes of this extraordinary fatality, but no one dreamed that the death-trap was the trap in the millionaire's costly but worse than useless plumbing.

The Sanitary Superintendent of Brooklyn examined the pipes and general plumbing, assisted by an expert. Among other things they found that some of the main lines of soil-pipe that are continued to the roof, do double duty—carrying off the sewer-gas and acting as rain-leaders. One of the pipes receives the water from 1,200 square feet, and during heavy rains is so filled with water as to empty every trap connected with it. The water-closet in the bath-room was found attached to this pipe, and its trap was so nearly emptied of water that it offered no obstruction to the entrance of sewer-gas. Mr. Rockwell had wash-basins in his sleeping-rooms and nursery, but the traps do not hold water, so of course the gas had no difficulty in gaining entrance. In fact, if the builder had desired to turn his house into a hospital and furnish his own patients, he could not have devised a better system of defective plumbing.

That diphtheria should prevail in this locality is not strange. At times the streets are strong with sewer stench, and the houses so offensive that it is next to impossible to remain in them. The sewers there drop almost perpendicularly to Furman street—a fall of 50 feet. There being no traps, there is a clear channel for the gas from the sewer. If on its way up the pipes the gas finds an opening, it naturally avails itself of it, and soon obtains access to the sleeping apartments. While all the houses are open to this criticism, the splendid mansion occupied by Mr. Rockwell's family appears to be about the worst in its plumbing details. That the gas did obtain an entrance in his house is evidenced by the sad results. An extraordinary feature of the inspector's report is the mention of a large tank which supplies water to the upper floor—water which the servants drink. An analysis showed that the water contains a large amount of organic matter, and is utterly unfit to drink. Its overflow pipe connects directly with the soil-pipe, and as there is no intervening trap, it would be difficult to suggest a better way for rendering the water malignantly offensive.

The report has worked up Brooklyn to a fever heat. Had it been shown that Furman street, or any of the older streets the other side of Fulton, were badly sewered, it would not have excited much surprise, but to find the homes of the "first citizens" at the zenith of disease and the center of foulness, was such an unlooked for discovery that "the boldest hold their breath," and well they may, for sewer-gas is not especially healthful.

The Board of Health has taken hold of the Rockwell house, and the plumbers will have a fresh opportunity to show how much they can do and charge for. The pipes along Pierrepont Place (where a beautiful park, formerly a part of the Pierrepont farm, borders on the yard of Simeon B. Chittenden) have been blown out, and Columbia Hights is to be thoroughly overhauled and put in order.

Manual Instruction in Public Schools.

Harper's Monthly for January makes some pertinent remarks in regard to the question of introducing manual teaching in our public schools. It says:

"There has been of late years a growing disposition to criticize our public schools, on the ground that they attempt too much, and offer a course of instruction out of all proportion to the practical use of the graduate; that knowledge and not training is made the end sought, and that in the desire to secure a high organization, individual powers and tastes are disregarded. Certainly the machinery of our public schools has grown more complex and costly, and it is to be feared that the children who leave them are confused oftentimes with knowledge rather than athleticized by training in elements of mental power. To a too intellectual training certain effects have gradually been introduced. The introduction of drawing as a regular part of education has been a marked advance in the right direction, although the best methods of teaching it are still under discussion. The introduction of music in more systematic form came earlier, and was a very important sign of educational progress. Latterly sewing has been introduced with marked results for good, and the chief regret of its friends has been that there was not some universal implement like the needle in the use of which boys might be trained."

The editor of this journal happens to have had some practical experience in this line during the two years (1864–1866) he was employed as Professor of Industrial Science in Girard College, Philadelphia. Notwithstanding the enterprise was only a partial success, he has come to the conviction that it is the greatest thing needed in our schools. The pupils like nothing better than to enjoy temporary release from the drudgery of learning lessons from books, and to be occupied with their hands. The whole problem lies in systematizing the various appropriate kinds of labor, and in employing each pupil at something adapted to his age and constitution.

The greatest objection is perhaps the expense, and this we fear will be the drawback hindering its universal introduction. It is not only the expense of tools and room for a work-shop, but also of proper teachers, as it requires many more teachers to keep say fifty boys occupied in this way than to put them in rows at desks, and let them read, write, and recite, when one teacher can easily control from thirty to fifty boys, while some teachers have much larger classes. Then, teachers able to instruct boys in the elements of useful, practical occupations, will have to know something else besides mere book-learning, and will command higher salaries, so that after all the whole thing is, like many others, a mere question of money. Indeed, it was only a lack of sufficient monetary appropriation for this enterprise that it fell through in Girard College. The expense of running the whole industrial class of sixty pupils, was, in his enthusiasm

to promote a good cause, borne by the Professor, who contributed his own apparatus and tools, but found his salary of $1,600 a year (without residence or board) utterly inadequate; and after waiting for two years for the always expected appropriations, finally resigned, and went, with all his apparatus, back to New York, whence he came.

New System of Draw-Bridges.

The engraving on the opposite page represents another of the applications which may be made of the system of moving loads by simple hydraulic pressure, as invented by Mr. William Burdon, corner Front and Pearl streets, Brooklyn, N. Y., the application of which to various elevators we illustrated and described on pages 265, 266, 267 and 268 of our December number for 1878, and for the turning of draw-bridges, described and illustrated on pages 6 and 7 of our late January number.

The system here represented is especially intended for canals of limited width, and where it is desired not to encumber the shores or the approaches with machinery. The bridge is operated by simply turning a wheel, as seen at the right-hand side of the engraving; this wheel admits water to a horizontal cylinder containing a piston, which, when the water is admitted, exerts a pull proportionately to its surface and the pressure of the head of water. In order not to oblige this pressure to lift more than the full weight of the draw, owing to the oblique direction of the pull, the following ingenious arrangement has been devised, by which not only the bridge is partly balanced, but the labor of the hydraulic lift is reduced to raising less than one-fourth of the weight of the bridge:

At the extremities of the piers wrought-iron hollow columns are erected, in which weights to counterpoise the bridge move up and down. The peculiar arrangement of these weights is one of the special merits of Mr. Burdon's invention. The weights are suspended by chains, which run over pulleys at the top of the columns. The weights in the columns at the left, which are about 20 feet high, counterbalance ¼ of the bridge when it is in its horizontal position, when each pier carries half the weight of the bridge. The weights in the columns at the right side, of which there are two sets, counterbalance more than half the bridge, while the remaining quarter, which, however, by increasing the counterpoises, may be made considerably less than a quarter, is carried by the hydraulic lift. It is clear that as soon as the bridge is raised on one end the strain of the lift on the upper end becomes less, and that in the lower or pivoted end becomes greater, so that when it has attained an incline corresponding with an angle of about 40° with the horizon, it will only have to lift an amount of weight proportionate to the cosine of 40°, which is ¾; at this position the weights in the short left-hand columns, which balance ¼ of the bridge, have reached the ground.

Our engraving represents the bridge in that position. Now the lower weights in the other right-hand columns, which balance another fourth part, assist in the further raising, until it has reached an angle of 60°. The cosine of this angle being ½ of the radius, it indicates that only ½ of the weight is left to be supported. The length of the chains supporting the lower weights in these long columns is so arranged that they then touch the ground. The upper weights still balance more than half of what there is left of the resistance, and they continue the work until the bridge has reached an angle of 75°, the cosine of which is ¼, which shows that only ¼ of the weight is to be lifted; at this point the last mentioned weights will in their turn touch the ground; and then, at the last part of its course the hydraulic pressure, which thus was aided by the weights acting as counterpoise, does the work alone, and brings the bridge in the erect position as indicated by the dotted lines in the engraving.

To lower the bridge the water supply is turned off, and the water before the piston allowed to escape gradually, when, just as gradually, the bridge will descend by its own weight; when it again reaches an incline of 75° and 60° the weights in the high columns will assist in counteracting its strain on the hydraulic piston; when it reaches 40° the weights in the short column will do the same, so that the bridge will come down easily and gradually, while the hydraulic cylinder or piston will never have to do more than lift ¼ of the bridge, or even less, if the weights and chains are arranged accordingly.

The greatest advantage is perhaps that this bridge can be raised and lowered very rapidly, which is of some importance at points where there is much traffic by vessels in the canal as well as by vehicles and foot-passengers over the bridge.

A Decision in the Woodbury Planing-Machine Patent Suit.

A decision has just been rendered in the United States Circuit Court in the famous Woodbury patent case which has been in litigation for the past 30 years. The decision was given by Judge Lowell and was adverse to the plaintiffs, the Court refusing to sustain the patent, on the ground of lack of originality. Had the patent been sustained, it would have covered nearly all the planing-machines in use in the United States, and its value would have been nearly $40,000,000, of which $10,000,000 is for royalties claimed to have accrued since its issue. A brief history of this case will be of interest to those readers who have not already read the article published on the subject in our November number for 1875. In that article we reviewed the whole matter and will here condense its most salient features.

The patent in suit (which is No. 138,452) was issued to Joseph Woodbury, April 29, 1873, 25 years after it was first applied for, and 27 years after the invention was completed. It is for an improvement in planing-machines, by which flat bars are placed before and behind the cutters, to keep the stock firm during the operation, instead of the rollers which were used by Woodworth, the inventor of this class of machines. Woodbury made application on the 3d of June, 1848, and appointed an attorney, but did not give him the usual authority. The power was so worded as not to enable him to withdraw the application, February 20, 1849, and nothing further was done until October, 1852, when the attorney withdrew the application and received $20. Of this Woodbury had no notice. In February, 1854, he instructed Mr. Cooper, a patent solicitor of Boston, to call up and prosecute the rejected application. There was a misunderstanding as to what invention was referred to, and it was only in November, 1854, that Mr. Cooper learned exactly how the case stood. The law of limitation prevented any further action on the matter until Congress revised the patent laws in 1869, when a patent was finally obtained, April 29, 1873. The Court decided that the invention of Woodbury had been anticipated by a machine built by one Anson, at Norwich, Conn., three years before, the patent having been applied for in 1844. There was no doubt that the Anson machine had bars instead of rollers. It has been running ever since, and was produced in court. Upon the points of objection taken by the plaintiff to the Anson machine, the Court decided that the bed of that machine was sufficiently solid to answer the purpose of Woodbury's bed, which was to resist firmly, like the anvil, the blows of the cutter, and that the bars which Anson made, instead of rollers, had a yielding pressure. The patent which Anson asked for had nothing to do with the bars, and there is no reason to suppose that he understood that there was any such advantage in bars over rollers as Woodbury saw and made known. He was not concerned with the particular matter of a yielding pressure bar, but the court decided that if he made it to yield he made the thing which Woodbury is, by a very proper, and indeed, necessary, fiction of the patent law, presumed to have knowledge of, and therefore when Woodbury pointed out the great advantage of this arrangement, he was merely applying an old machine to a more extensive use. The Judge concluded: "I believe him to have been an original and meritorious inventor, but of a change which was not difficult to make or invent, and of which, as it turns out, he was not the first inventor."

These suits instituted nearly three years ago, are defended by an association of persons using the machines or representing users. The patentee is dead, and the plaintiffs are a corporation to whom he had assigned his patent. Counsel for the patentees were the following: Ex-Commissioners Burke and Fisher, Messrs. Greenough, Stoughton, Dodge, Munn, Duncan and Drew, of Washington; Stoughton, Cozzens and Dickerson, of New York; Giles, Woodbury, Edison, Curtis, Cooper and Whittier, of Boston; Strout and Clifford, of Portland. For the defendants: Benjamin F. Thurston, D. Hall Rice and Charles E. Pratt.

It is thought that an appeal will be taken from the decision of the court, but no action has, we believe, yet been decided upon.

A Water-Wheel Test.

The city water-works of Minneapolis, Minn., which lately advertised for two turbine wheels, of 300-horse power each, to pump water into their reservoirs, decided to have the contesting wheels tested at the Holyoke flume in the Connecticut River, before April 1st by the engineers of the Lawrence water-power company. The wheels to be tested are the "Risdon," the "Swain," the "American" and the "Victor." The Holyoke Machine Company representing the "Hercules" wheel, and the Ames Company representing the Boyden were both a day too late in applying and so are shut out; but in case the contesting wheels fail to "toe the mark," there will be a new trial, to which all will be admitted. The Ames Company intend in that case to test their Boyden wheel at the Holyoke flume for the first time, which will necessitate putting in a "quarter turn."

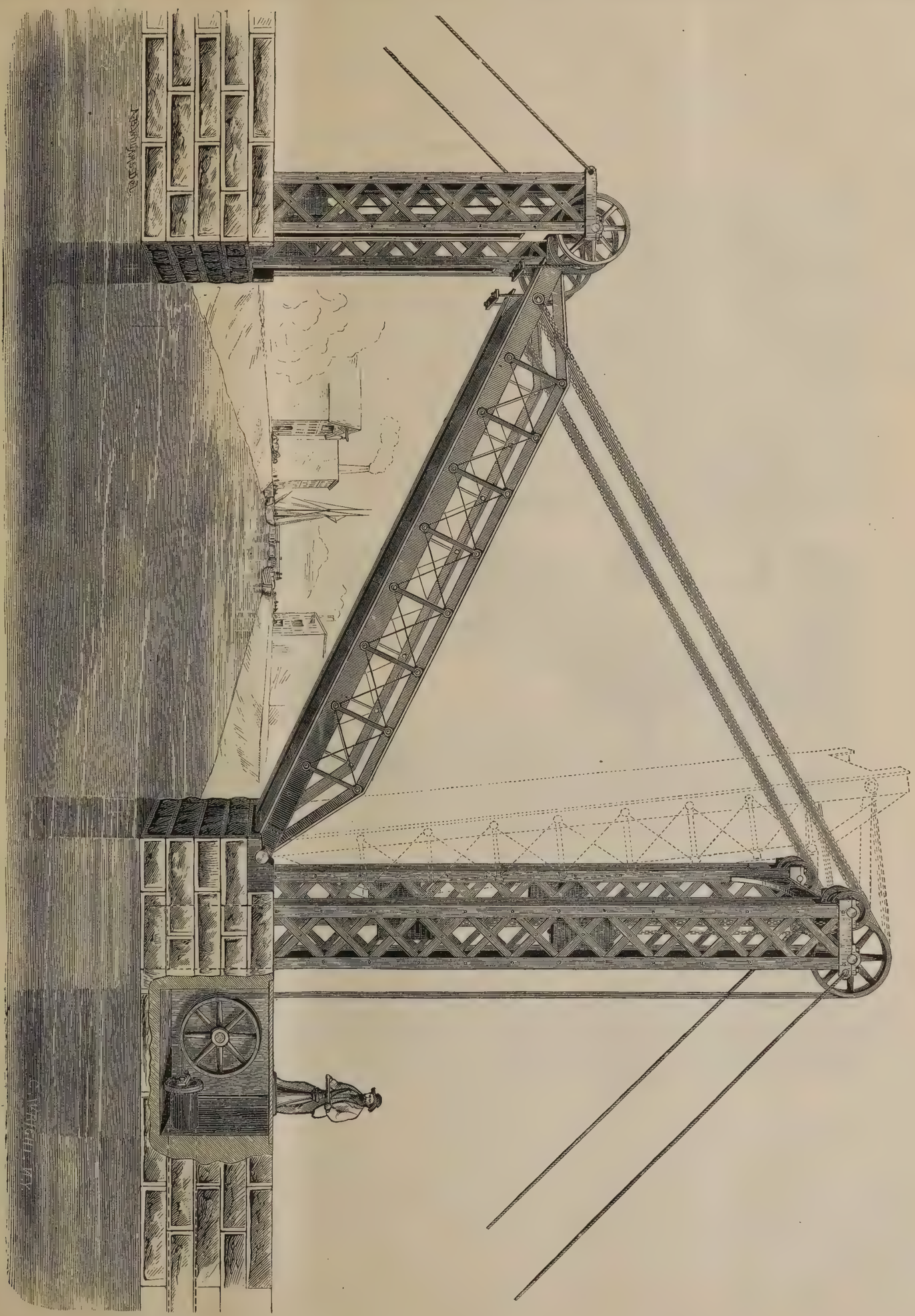
The Risdon agent offered two of his 60-inch wheels of 375 horse-power each for $2,100 apiece; Swain, two 54-inch wheels for $3000 apiece, and the American Company, two 48-inch wheels for $1,300 each. The Minneapolis people demand that the average of ½, ⅝, ¾, ⅞ and full gate shall show 76 percentage for a 30-foot fall. Local authorities differ as to the ability of the wheels to show this. Mr. Emerson doubts it, and the Ames Company think it highly probable that a new series of tests will be necessary. This trial will be of considerable interest. As the Holyoke flume has only a 20-foot fall, there must be considerable figuring to show the required results for a 30-foot fall.

Safety Hatch-Covers.

The recent great fires in New York proved, as have so many fires in our large cities, that one of the greatest elements of danger are the hatchways, which constitute an arrangement especially adapted to establish, as soon as a fire originates, an upward draft on one of the floors, and by this draft aid in fanning the flames, thus communicating the fire at once to the upper stories.

The Excelsior Hatch Cover Co., office, Room 4, 120 Broadway, New York, have a very useful invention in their self-adjusting and automatic hatchway covers, an advertisement of which will be found on page 3 of our advertising department. These covers consist in a mechanical device by which all the hatchways can be closed and opened any time by one operation. It is clear that this is a great advantage if the hatches can always be kept closed between working hours—at night and on Sunday—that is during the time when the danger of fire is greatest.

The invention has been universally endorsed by architects, builders, occupants of mercantile buildings, and insurance companies. They been adopted by the owners of many of the principal estates in this city, among which we may mention the Rhinelander and Lorillard, and have already been constructed in a very large number of the principal stores, warehouses, and other buildings in New York, Boston, and other cities of the United States.



BALANCED DRAW-BRIDGE MOVED BY HYDRAULIC PRESSURE.

American File Manufacture.

At the present time by far the greater part of the files manufactured and used in the United states are machine-made in every part. Hand-cutting is still carried on, but mostly in a small way. There are a great number of shops making hand-cut files, producing from one to two dozen per day, but they depend chiefly upon the profits of re-cutting. The statistics of the file industry of the United States may be briefly summarized as follows: There are seven manufacturers making machine-cut files, operating together about 275 machines, which at the present time are probably averaging about 1,500 dozen files per day. These seven companies also produce together about 200 dozen hand-cut files, making a total of 1,700 dozen per day as the product of the seven principal file manufacturing companies. The smaller manufacturers before mentioned make only for local consumption, and seldom sell to the trade. Of the whole number not included in the seven already mentioned, probably not more than fifteen manufacture for the general market, and their aggregate production would not amount to more than 500 or 600 dozen per day. Probably the total production of the United States is about 2,500 dozen per day.

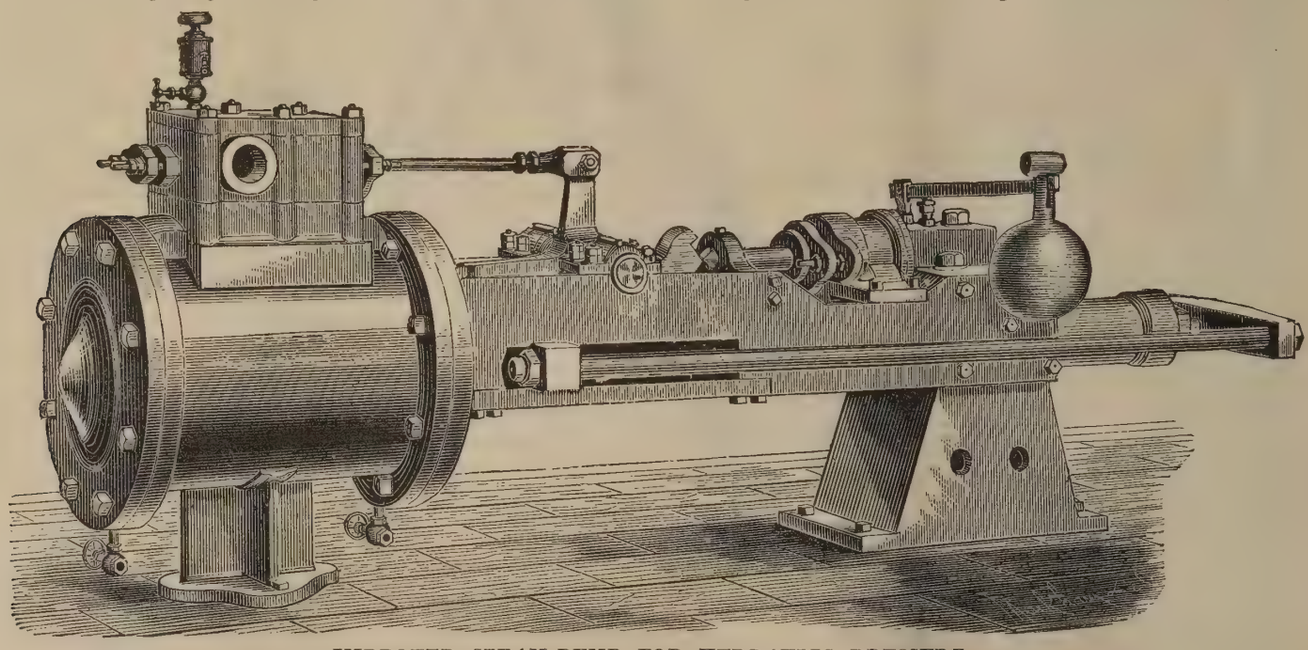
Among the most prominent manufacturers in this article of production are the Nicholson File Company, of Providence, R. I., whose works have been in existence for fifteen years. They manufacture machine-made files exclusively, and at first experienced a very strong prejudice in favor of hand-made files; this, however, they overcame, and have succeeded in introducing their goods into every section of this country, and even abroad. A peculiarity of these files is that finished files, intended for horses' feet, wood, leather, brass, and other materials softer than iron, are further improved and made still sharper by submitting them to the action of a gritty liquid impinged upon the teeth.

We have before us a quarto publication of 80 pages, entitled "A Treatise on Files and Rasps." It is profusely illustrated, and describes the various kinds of files, the newest and best special tools connected therewith, their use, and explains the process of manufacturing files. It is published by the Nicholson File Co. above referred to, and is one of the finest publications on a special subject which has ever come into our hands. We learn from it, as was to be expected, that this company obtained the first award at our International Exhibition at Philadelphia.

GOLD IN PETROLEUM.—Mr. John Turnbridge, of Newark, N. J., has discovered that many kinds of crude petroleum, and the refuse of distillation, contains gold. He poured crude petroleum on shavings, burned them, collected the ashes, and made the usual assay; the result was a small pellet of pure gold in the cupel. Distilled refuse assayed gives $35 worth of gold to the ton, besides the element molybdenum.

Improved Steam-Pump for Hydraulic Pressure.

The engraving on this page represents a new style of steam-pump, especially devised for the production of high hydraulic pressure. For this reason there is, as the figure shows, a great difference in the diameters of the steam and the hydraulic plungers, the diameter of the former being 14 inches and the latter 1¼ inches; and as the pressure is as the square of the diameter, it is as 14 × 14 to 1¼ × 1¼, or as 196 : 2¼. As the last number goes into the first 87 times, the pressure is increased in that ratio, so that a pressure of say 60 pounds on the steam-cylinder will become 60 × 87, or 5,220 pounds per square inch. Such a pressure, if diffused over the large plunger of a hydraulic press of say 20 inches diameter, or 313 square inches surface, will exert a final effect equal to 1,633,860 pounds, more or less, according to the amount of steam pressure.



IMPROVED STEAM-PUMP FOR HYDRAULIC PRESSURE.

It is evident that these pumps are useful for all manufacturers who require great hydraulic pressure, for instance, for testing in pipe and tube works, but especially for users of hydraulic presses, such as those for pressing cotton and tobacco for exportation, also in paper-mills, hat factories, steel works, etc.

This pump is in use in McPherson's tobacco works at Louisville, Ky., for pressing tobacco for exportation, making it possible to press as much as 3,000 pounds in a hogshead. It is also very well adapted to compress plug tobacco, which fact the makers desire to bring under the special notice of the manufacturers of this article, and also request the attention of all who are in want of machines exerting extra high pressure.

The style here represented has been tested up to 10,000 pounds per square inch, but if desired they may be made of capacities up to 100,000 pounds per square inch; while if applied to hydraulic presses in which the pressure is multiplied 100 or 200 times, they may produce the enormous pressure of 10,000,000 or 20,000,000 pounds, equal to 5,000 or 10,000 tons.

It will be seen that this pump is direct-acting, which is in all cases the most economical expenditure of force; it is also double-acting. Over the water-cylinder in which the plunger works, is a safety-valve, with a weight moving over a lever, so that by sliding this weight the pressure may be regulated to any desired degree within the limit of the capacity of the pump.

The manufacturers are Messrs. Smith, Vaile & Co., of Dayton, Ohio, who make the manufacture of hydraulic machinery a specialty, and also furnish hydraulic presses suited to any purpose, and made in the most approved style in regard to durability and strength.

Petroleum as Fuel for Steam-Boilers.

Our views on petroleum as fuel for steam-boilers, published in our late December number, (page 270), are also shared by the London *Engineer*, in so far as to declare all attempts thus far made decided failures. That paper, however, enters into a calculation intended to prove that coal must be cheaper in any case, even supposing that petroleum would cost only 2 cents per gallon; for certain localities this is correct. Certainly there would be no economy in its use in England, where there is still coal enough, (at least as long as it lasts), and where petroleum has to be imported. But here, especially in regions where petroleum is plentiful, and often runs to waste, it would be very desirable to have a good steam-boiler furnace for the effective combustion of petroleum. The principal difficulty appears to be the imperfect combustion thus far experienced, causing a black smoke, and covering the boilers with a splendid coating of non-conducting material, which obstructs the passage of the heat of the fire to the water in the boilers.

The *Engineer* appears to be of the opinion that further attempts in this direction are useless, and urges engineers to confine themselves to coal. We, however, do not share this opinion, and maintain what we said at the close of our article in our December number.

CHEAP MILL-DAM.—A cheap and substantial dam may be made where timber is abundant by laying a foundation of logs of considerable size, which are placed parallel with the stream and close together, forming a sort of corduroy road extending from bank to bank. If the bottom is soft, the logs should be carefully fitted down and adapted to the inequalities of the bed and if placed as deep as possible they will be less liable to decay by exposure in time of low water. The breast-work of the dam is built near the up-stream side of this foundation, the logs extending from under it down stream, and serving as an apron to receive the waste water as it comes over. The rafters and coverings of the dam form an inclined plane on the up-stream side, and extend over the upper ends of the logs, protecting the foundation from being undermined by the water working beneath it.—*Leffel on Mill-Dams.*

Improved Metallic Shingles.

Of the adjoined engravings, Fig. 1 represents the form of an improved metallic shingle, which, when laid alternately, overlaps so as to form a double and water-tight metallic and therefore fire-proof roof. The method of this overlapping is represented in Fig. 2, while in Fig. 3 is shown the way to lay it. It is easily seen from these figures that the point of each shingle is held down by the slot or projection at the shoulder of the two shingles of the next course below, while the holes form an absolute guide in laying the roof. If care be observed the whole roof will be laid with no trouble whatever, as experience fully proves. It will also be seen that as the point E of the shingle in each course passes under the raised projection H made for it in the next course below, while the corrugated edge A fits over the corresponding corrugation B in the body of the shingle, and is securely held in place by the point E in the projection H, and also by the manner of nailing, it is impossible for storms to beat under; while the point E being settled down, the thickness of the iron fits closely on the central rib of the shingle underneath it. Thus the roof is storm-proof, as the shingles lie closer, have a full 3-inch lap, and are fitted to one another. The edge C of the shingle fits closely to the central rib D, while the upper corner of the shingle J being flattened, serves as an additional guide in laying the roof, as they touch loosely when rightly laid. The corrugation I serves to strengthen and stiffen the shingle. Each succeeding course should commence at the line C D, Fig. 3, being careful that the central rib of each alternate course shall come directly over the line. The pitch may be the same as for slate or ordinary shingle roofs, but 2 inches to the foot is sufficient.

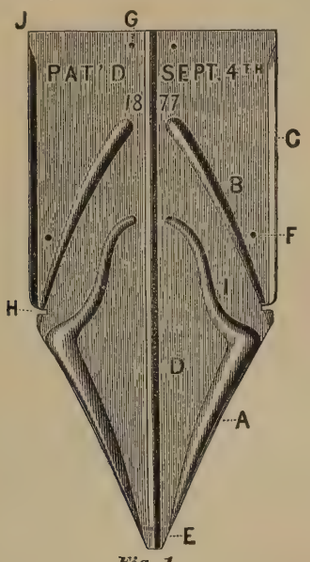


Fig. 1.

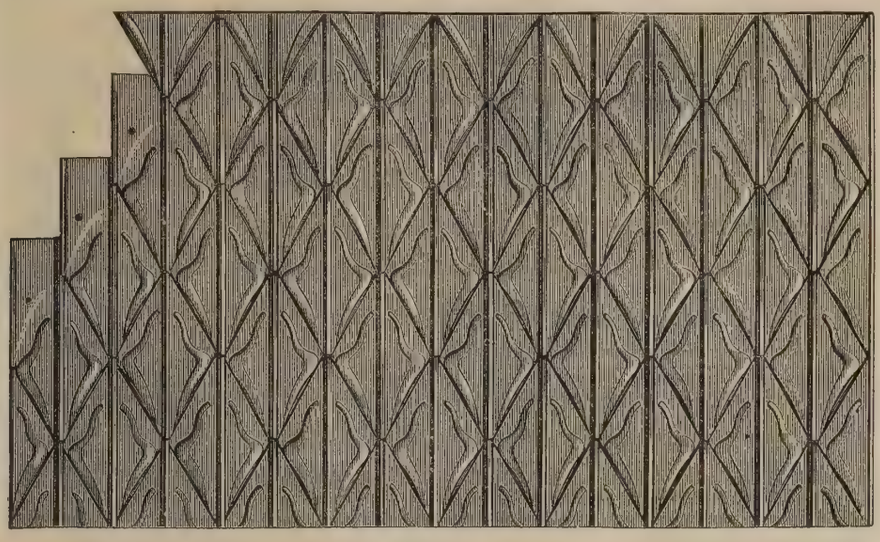


Fig. 2.

The advantages of such a roof over slate, are that it is lighter; being less than one-fourth the weight of an ordinary slate roof, it allows the use of much lighter roof-timbers, and produces much less strain on the frame of the building. It is made of wrought metal, and readily adapts itself to the formation of the roof without breaking, and from the peculiarity of its construction, lays much tighter and closer, leaving no holes or places through which storms can beat. It is more thoroughly fire-proof. If slate be heated by fire in an adjoining building, it flies into pieces, leaving the building exposed, and this is especially the case if water is thrown upon it while hot. This shingle being of wrought metal, will not crack or come off, but immediately cools when water is thrown upon it, thus continuing its protection to the building. It will not crack from the action of frost, nor will the nail-holes become worn and broken from the action of heavy winds; neither will it break from the falling of any weight upon it. In these respects it possesses decided advantages over slate, saving much annoyance and all expense for repairs.

As compared with the ordinary tin roof, it is evident that it avoids all danger of leaks from expansion and contraction of the metal, as each shingle is laid and fastened by itself, and is at liberty to expand and contract without in the least affecting the qualities of the roof. It requires no solder in laying, and is a more complete protection in case of an adjoining fire, as the shingles will not warp, nor is there any solder to melt

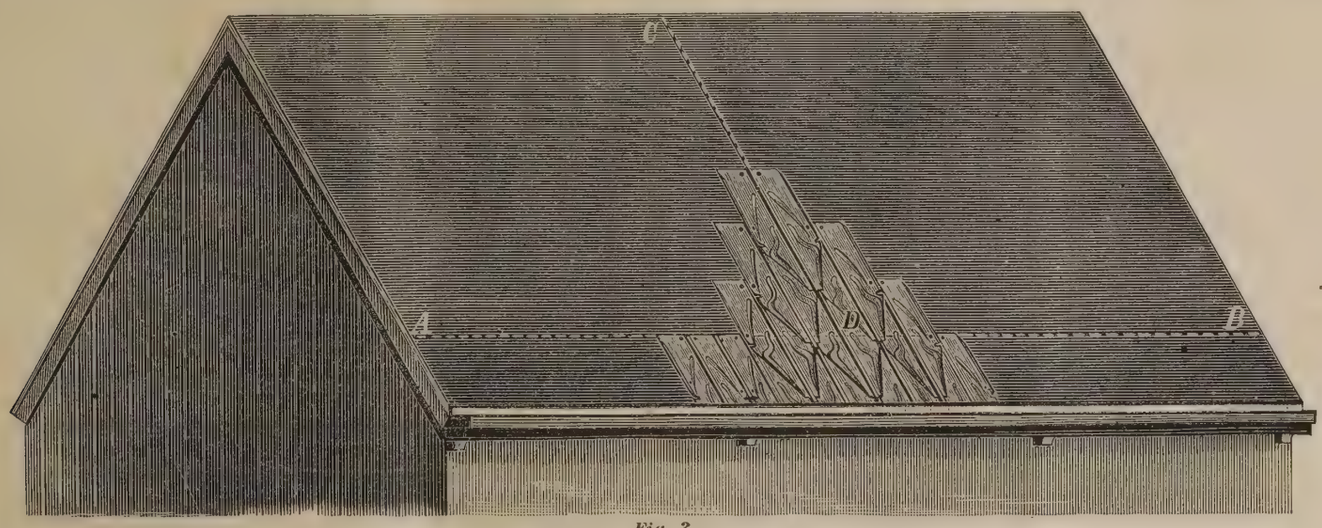


Fig. 3.

elevated ridges fit into one another. An explanation of the manner in which they are laid will make this clear. First snap a chalk-line A B, Fig. 3, along the eaves, at just the distance from the edge of the roof that you wish the top of the shingle in the first or eave-course to come, say 9 inches, if you wish the shingle to project half an inch over the eaves. Then at such place in the roof as you may choose, either in the middle of the roof or at the end, snap the line C D exactly at right angles to the line A B, and coming down to the edge of the roof. At the intersection of these lines commence to lay, placing the central rib D of the shingle over the line C D, the top of the shingle to come to the line A B. The flattened edge J of the next course of shingles will come to the line C D, while the central rib of the third course will come directly over the line, and so on.

If care be observed in laying the first course that the top of the shingle comes to the line A B, and the central rib at exact right angles to it, it will be found that the hole F in the lower dart of the shingle will come directly over the hole G in the upper part of the shingle in the next course below, and thus these nail-

off and thus leave the building exposed. It is made of much thicker and heavier material, besides being laid double, and with ordinary care will last as long as the building stands.

The sources of leaks in a tin roof arise principally from three causes: 1st. On a pitch roof it is very difficult to properly solder the seams, and when the metal expands and contracts from the varying temperature, they are liable to break away. 2d. Rust or corrosion in a tin roof takes place most frequently from the under side where it is not possible to paint it, and after a time the rust eats through. 3d. The tin, being light and very thin, is easily pierced by any of those unavoid-

able accidents which so frequently occur.

It will be seen that this roof is free from those objections which are urged so frequently against a tin roof. In comparing it with a wood-shingle roof, it is clear that it does not shrink or warp. This tendency of a wood shingle is a prolific source of leaks. We need not speak of its fire-proof qualities here, as no one pretends that a wooden roof is fire-proof. Then it is much more durable; it is well known that most of the wooden shingles now used are of the common sawed or shaved kind, that last but a little time before they need repairs, and will not last on an average but a very few years.

This roof is easily laid by any carpenter. It is a metallic slate or shingle, to be laid in courses the same as a slate or wood shingle, is already prepared, the nail-holes in each course being covered by the shingles in the course next above, and the points being held down by slots made for that purpose in the shingles of the course next below, as shown in Fig. 3. These shingles are made of iron, and prepared for use in two ways: One is by covering them before they leave the factory with a coat of metallic paint. Experience has shown that they will not rust on the under side, nor in the laps, and if, when they are laid, they receive a coat of the paint, to make good any scratches that may have occurred while laying them, they will last for years without further expense. An occasional coat of paint will keep this roof in perfect order. They are also made "calamined," a process similar to galvanizing; it is the result of long and patient study and experiment, and is now made public after having been thoroughly tested under varying circumstances, and always with the very best results.

These slates or shingles will not rust; they will stand exposure to the weather on our sea-board, or any climate, and give entire satisfaction. Iron coated with this composition has been put on trial with galvanized, tinned, and leaded iron, and in every instance the latter three have given way and begun to rust, while the calamined shingles have shown no indications of corrosion. A roof covered with these slates or shingles will cost nothing for repairs or painting, unless it is desired to paint them for the sake of color, and will last as long as the building stands.

The size of each slate or shingle is $8\frac{1}{2} \times 16$ inches; a square is enough to cover 100 square feet of roof, or a space 10×10 feet. They are packed in cases for transportation, one square in a case, weighing 140 pounds, and shipped at the lowest freight rates. They are delivered in New York, Boston, Chicago, Philadelphia, Baltimore, Cincinnati, St. Louis, or New Orleans at the following prices: painted, $6.50 per square; calamined, $8.50 per square; the paint, $1 per gallon.

This paint is made of well-known and approved material, dries quickly, and will not wash off in storms, nor in any way taint or discolor cistern water. The manufacturers only ask a trial, being sure it will give entire satisfaction, and that in using it for painting any roof it will give greater benefit for less money than any other in the market; while it is equally well adapted for use wherever the object is to protect iron from rust or corrosion.

The above described shingles and paint are made by the Iron-Clad Manufacturing Company, of 52 Greenpoint avenue, Brooklyn, (E. D.), N. Y.

A Great Iron Contract.

The Metropolitan Elevated Railroad Company have awarded the contract for the iron-work of their Second avenue line to Clarke, Reeves & Co. of Philadelphia. This is said to be the largest iron contract ever awarded in this country, 50,000,000 pounds of iron being required for the work. There will be 2,000 iron columns and 6,000 girders. The contract for the west side extension, in addition, comprises 27,000,000 pounds of iron. The Second avenue line is to be completed by September 1, and the west side extension by July 1, so that the above firm have undertaken to furnish nearly eighty million pounds of iron and construct nearly twelve miles of a double-track road in a little over six months from now. These figures, moreover, are only upon a basis of a two-track road for Second avenue, while the structure is actually designed for the ultimate use of three tracks, and that number is to be put in already along a considerable portion of the road. The contractors are to build the entire Second avenue road, with the exception of foundations, ties, rails, switches and stations, which the company itself will provide. The erection of the stations will probably be contracted for as soon as the engineers have definitely laid them out.

As the Second avenue line is particularly designed for the running of express trains, the company have increased the strength of the structure thirty per cent. above even that of the Sixth avenue road, making the factor of safety eight.

Building Intelligence.

NEW YORK CITY.

IMPORTANT PROJECTED BUILDINGS.

West side 3d av, extending from 101st st to 102d st, ten 5-story brown stone stores and tenements; cost, each, $10,000; builders, Duffy Bros.; architect, F. S. Barus. No. 49 Leonard st, 6-story iron store; cost, $20,000; architect, S. M. Clarke. Nos. 107, 109 and 111 Greene st, three 5-story brick warehouses; cost, each, $15,000; architect, C. C. Haight; builders, Van Dolsen & Arnott. Northwest corner Park av and 64th st, 4-story and attic brown stone store and flats; cost, $11,000; architects, D. & J. Jardine. North side 51st st, 200 ft west 5th av, nine 4-story Conn. brown stone dwellings; cost, each, from $16,000 to $30,000; builders and architects, Duggin & Crossman. No. 30 West 14th st and No. 29 West 13th st, 4-story brick and iron store; cost $25,000; architect, J. B. Snook; builders, John Banta and McGuire & Sloane. North side 59th st, 95 ft west Madison av, four 4-story Conn. brown stone flats; cost, each, $12,000; builders, Smith & Bannon; architect, John B. Snook. No. 125 Bowery, 5-story brick store; cost, $16,000; architect, Robert Mook; builder, M. Eidlitz. East side 3d av, 50 ft north of 168th st, 3-story brick storage; cost $12,000; architect, A. Pfund. No. 109 Greenwch st, 6-story brick tenement; cost, $16,000; owner, etc., Edward Burke. No. 333 East Houston st, 5-story brick store and tenement; cost, $12,000; architect, J. Stroud; builder, J. T. Duffy. South side 81st st, 150 ft west 1st av, 4-story brown stone flat; cost, $10,000. Nos. 136 and 138 West 54th st, 3-story brick stable; cost, $13,500; architect and builder, E. Smith. Northwest corner of 5th av and 128th st, five 3-story brown stone dwellings; cost, each, $12,000; architect, G. B. Pelham. North side 128th st, 115 ft west 5th av, two 3-story brown stone dwellings; cost, each, $10,000; architect, G. B. Pelham.

BROOKLYN, N. Y.

IMPORTANT PROJECTED BUILDINGS.

South side Bergen st, 400 ft west 5th av, four 3-story brown stone flats; architect, F. F. Thomas; builders, Levy Brown & J. W. Gray. No. 81 Henry st, near Cranberry, 4-story brown stone flat; architect, M. J. Morrill. North side Van Buren st, 150 ft east Bedford av, four $2\frac{1}{2}$-story Conn. brown stone dwellings; architects, Parfitt Bros. East side Washington av, 175 ft north Lafayette av, three 3-story Conn. brown stone dwellings; architects, Parfitt Bros. Northwest corner 5th av and 5th st, 5-story and 2-story brown stone stores and dwellings; architect, Robert Dixon; builder, W. M. Hall. South side Keap st, about 25 ft east Lee av, four 3-story brown stone dwellings; architect, W. H. Gaylor; builder, J. Haseyhion. West side St. Felix st, 104 ft south De Kalb av, 3-story brown stone dwelling; architect, Lemuel Burrows. South side 3d st, 140 ft east Clinton st, two $2\frac{1}{2}$-story brown stone dwellings; architect, Thos. F. Houghton; builder, Peter Kelly. West side 8th st, 25 ft north Division av, five 2-story brown stone dwellings; architect, Wm. H. Gaylor; builder, Thomas Gibbons. East side Grand av, 357.5 ft north Gates av, $2\frac{1}{2}$-story brown stone dwelling; architect, A. A. Reeve; builders, P. Sullivan and A. A. Reeve. North side South 5th st, 125 ft east 1st st, 3-story brick storage warehouse; architect, John Dibble; builder, Geo. H. Stone. Corner 6th av and 9th st, 3-story brown stone store and French flats; architect, Robert Dixon; builder, W. M. Hall. South side Fulton st, 75 ft west Rochester av, five 2-story brown stone stores and dwellings; architect, J. N. Smith; builder, Wm. Gibson.

GENERAL BUILDING NOTES.

Dr. P. W. Hill is building a house on Columbus Avenue, at Madisonville, Ohio.

The Cunard Steamship Company has filed plans for a new freight-house, to cost $46,000 and to be built on pier 40 North River.

The Methodist Episcopal Society at Owensboro, Ky., will commence building early in the spring, an edifice to cost $16,000. Style, early English Gothic, from drawings by Boyd & Brickley, and under the charge of Brickley & Reid, architects, of Evansville, Ind.

At Ballston, N. Y., Hon. Geo. West has commenced rebuilding his old mill and erecting another. The second building will be 100 by 40 feet and three stories high. A boiler house, with a chimney stack 100 feet in hight, is also to be erected.

A new hotel is being built by Charles L. Hunt, at the northeast corner of Ninth and Chestnut streets, St. Louis, Mo. It will be brick, with stone facings, and have a frontage of 85 feet on Chestnut street and 81 feet on Ninth street. The main entrance will be on Chestnut street, and the building will contain one hundred rooms.

At Manchester, N. H., Mr. G. W. Stevens, architect, is building for himself a house which will cost about $10,000; also a house for Thomas Wheat, Esq.; cost, $5,000. Mr. E. C. Gardner, architect, of Springfield, is building a house for W. C. Rogers, Esq., which will cost $6,000. Mr. A. G. Stevens is building several houses, which vary in value from $1,500 to $4,000.

Since the removal of the legal restrictions that have for years kept the Rhinelander property in this city unproductive, the estate have determined upon a series of improvements that will benefit the city and make their real estate more remunerative to themselves. It is announced that 400 new buildings will shortly be commenced on First, Second and Third avenues, on Avenues A and B, and on Eighty-eighth, Ninetieth, Ninety-first and Ninety-second streets. The buildings on the avenues are to be chiefly stores and flats, those on the cross streets substantial dwellings. The completion of the east side elevated railroad, and the cheapness of material and labor, led the managers of the property to regard the present as the most favorable time for the improvements.

The Morse Building at the corner of Nassau and Beekman streets, in this city, is now nearing completion. The structure standing on the site of the old Park Hotel fronts 85 ft. 3 in. on Nassau and 69 ft. 7 in. on Beekman streets. There are eight stories and basement, including an as yet unfinished attic, the whole rising fully 145 feet from the curb line, and with walls which present the highest straight line in any of our city edifices. The thickness of these walls is forty-eight inches in the cellar and three feet and a half on the lower floor. The style of the building is distinctly modern—an adaptation of the Romanesque and Gothic combined, still with well-curved Roman arches. The main entrance is built of brick and terra cotta, except the entrance steps which are of Wyoming blue stone. This main entrance is flanked on each side by marble trimmings and wainscoting, and the main hall runs directly back to the elevators and contains the great staircase. The entire floor is laid with tiles and the staircases are of iron with marble and slate steps. There will be about eighty offices in the building, which will be ready for occupancy on the first of May next; it is fire-proof throughout, and constructed with beams at spans of about 7 feet, spanned with corrugated arches, and filled in with concrete.

Illuminated Buoys.

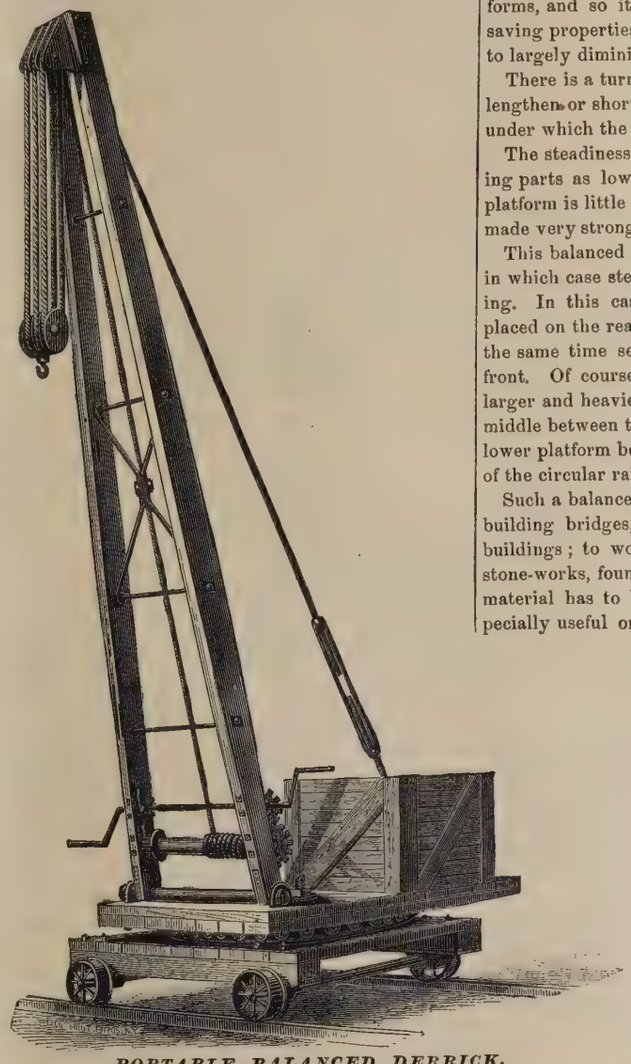
The *Pall Mall Gazette*, of London, says: "That the buoys which mark channels and wrecks are sometimes destroyed or displaced by vessels running along the coast on dark nights, is well known. After two trials of lighted buoys, therefore, the Trinity Board have resolved upon sending a buoy, of which the lantern can be kept continuously burning, to a station off Dundee. The first of these trials took place in August last at the Trinity Wharf, when the light lasted uninterruptedly for twenty-eight days. Water was pumped upon it from a steam-engine, to ascertain what would be the effect of the shock and drenching, and no harm was done. The buoy was then sent down to the Nore, and there burned steadily for twenty-four days. The same buoy has now left London for its appointed place near Dundee. Provision has been made for keeping it lighted without any interference for thirty-four days. It is a buoy of most awkward construction; but this does not lessen its usefulness, and others are being more skillfully made to receive the same illuminating apparatus. This is a modification of what is known as Pintsch's compressed gas system. It was first brought out in Germany, and originated from the demand of the railway authorities for a better means of lighting their carriages than that afforded by common oil lamps. After several failures with coal-gas, Mr. Pintsch at last adopted a rich, heavy gas extracted from oil, which he employs in a compressed state; and he soon found that it was not only better, but easier to make the lighting of each carriage independent of the rest. The gas is produced by a simple and not costly apparatus for distilling shale oil, or any fatty material. It is then purified, compressed to the extent of ten or twelve atmospheres, and stored in metal cylinders. A supply sufficient for use during thirty or thirty-five hours is, as required, taken into light wrought-iron holders (at about six atmospheres pressure) fixed beneath the carriages. The cylinders are provided with an ingenious arrangement by which the pressure is regulated and equalized, and the gas allowed to issue and supply the burners. The gas is burned through a small fish-tail burner placed beneath and close to a convex reflecting surface of white enamelled iron, in which a small slot is made to admit the passage of the heated air to the chimney. The necessary atmospheric air enters through the lid of the lamp.

With regard to the floating lights, it is proposed to make the buoy itself the receptacle for containing the compressed gas, with its regulator (which is one of the most important points of the invention) and the lantern at the top of a short conducting tube. A buoy of ordinary size will burn about three months night and day with only one filling, and the light is visible at a distance of about four miles. There is, however, in existence an electric lighting apparatus which might be employed, so that the light could be extinguished at sunrise and restored at night, giving of course a much longer duration to the working of the buoy."

Utilization of Peat.—For years experiments have been made to utilize the large peat beds of Massachusetts, Connecticut and other States for fuel. In 1865, when coal was from $12 to $14 per ton, a large amount of peat was cut and dried for steam purposes; when the price of coal fell, the cost of preparing the peat was too expensive and it was abandoned. A new process has been discovered for burning the peat just as dug from the swamps, thus saving all the expense of careful cutting and drying. Peat is the first formation of all coal beds, and in the overturning of the earth's surface the beds were crushed into veins, the moisture being pressed out, forming the basis of the petroleum oil deposits. In a bed of peat near Boston the lower part of the deposit shows strong signs of crude petroleum oil. During the last days of the Mechanics Fair at Boston peat dug in Roxbury was employed to produce all the steam required to run the machinery. Experiments were also made in burning salt marsh peat. The importance of this cheap fuel for Massachusetts will be understood when the fact is known that there are more acres of peat land in that State than the entire amount under cultivation. It is to be found in large quantities near Fall River, Lowell, Lawrence, Springfield and Worcester, also all over the western part of the State.

Portable Balanced Derrick.

Almost every one is acquainted with the common derricks used for hoisting building material for the erection of fronts of houses; they are still of primitive construction, troublesome to move about, and the ropes intended to keep them in position are inconvenient, as they always require an attachment by back guys to a kind of anchorage in the rear; but the principal inconvenience is that the material has to be brought just in front of them, as they can only lift, but are incapable of sideward transportation.



PORTABLE BALANCED DERRICK.

A derrick in which these defects are corrected is represented in the adjoined engraving. It is the invention of Mr. Frank Lyons, who recently obtained a United States patent for the same. The first improvement is that it stands on a second lower platform, which is supported by wheels running on rails laid down for temporary use. By this arrangement it is easily moved about sideways, even while a load is hanging on it. The second improvement is that the ropes supporting it in position, or the back guys, are not attached to an immovable anchorage in the rear, but to the end of the upper platform which carries the frame; on the other end of this platform a counterpoise keeps it in position, while this counterpoise can be increased at will, if, during the raising of a load, it is found that there is a tendency of the rear end of the platform to be lifted. This way of steadying the derrick possesses the advantage of securing a free motion in all directions, and makes it possible to apply the third and most important improvement, which is that the platform-car supporting the frame has on its top a circular rail with a set of rollers, of which the axes are placed like the radii of a circle, and on the top of which another circular rail turns easily. This latter rail is attached to the upper platform of the derrick, carrying the beam, counterpoise, etc., and thus the whole arrangement can be turned on its axis, and, for instance, a stone lying behind the derrick, be lifted, brought forward, and carried to its place of deposit.

It will thus be seen that this derrick can not only be moved from right to left with the greatest ease, running as it does on a straight track, but also that it can turn round on its circular track between the two platforms, and so its usefulness, convenience, and labor-saving properties are evident, as it renders it possible to largely diminish the labor of handling the material.

There is a turn-buckle in the guy rods, intended to lengthen or shorten them, and thus change the angle under which the frame or legs can be placed.

The steadiness is secured by having all the supporting parts as low as possible, so that even the upper platform is little above the ground, while every part is made very strong, substantial, and of the best material.

This balanced derrick is also made on a larger scale, in which case steam-power is employed to do the hoisting. In this case the hoisting engine and boiler are placed on the rear end of the upper platform, and at the same time serve as a counterpoise to the load in front. Of course in this case the platforms are built larger and heavier, and an extra rail laid down in the middle between the two others, in order to support the lower platform better, and to secure the equal working of the circular rail.

Such a balanced steam derrick is very suitable for building bridges, viaducts, churches, or other large buildings; to work in quarries, on railroads, docks, stone-works, foundries, and other places where heavy material has to be moved or hoisted. It would be especially useful on docks where a track has been laid lengthwise and the derrick can move about, unload vessels, and deposit the load on the pier or on wagons, or, inversely, to take heavy loads directly from wagons, and, by turning, bring them over the vessel and deposit them in the hold.

Further information may be obtained by addressing the manufacturer, Frank Lyons, 14 Center street, New York.

New Method of Setting Telegraph Poles.

A new and improved method of planting telegraph poles has recently been discovered and tried with success in Titusville, Pa. The ground being staked off at distances of about 200 feet apart, a man starts off with a pocketful of four-ounce cartridges containing a new explosive known as "electric powder," and with a crowbar in his hand. A hole from four to five feet deep is punched with the bar in a few minutes, and a cartridge dropped to the bottom, with a fuse attached, which is lighted with a match. The operator then walks to the next stake, before reaching which a low, dull thud is heard behind; a hole about the diameter of a flour barrel has been blown in the ground to the depth of four or five feet, and the work is followed up by a gang of men who plant the poles in the holes thus made, fill in with gravel and earth, and the job is complete.

It matters not what soil is perforated with the bar, wet or dry, loam, clay, gravel, slate, or boulders, (provided the bar can be inserted), the effect is the same. A gang of four men, with poles delivered on the ground —one man to blast and three to erect the poles and tamp them—will put up from 100 to 150 poles a day. The cost, therefore, of this new and improved process

is about two-thirds less than the ordinary method of planting telegraph poles, as now practiced.

List of Sizes of Water, Gas, and Steam Pipes.

It is well known that the manufacture of wrought-iron pipes and fittings for water, steam, and gas has grown to such a magnitude as to have become a leading industry of the day. It is therefore natural that the great and increasing demand requires that the sizes should be classified according to a system, especially for the sake of economy, both to manufacturers and consumers. This has already been done to an extent which leaves little margin for improvement.

Of late years the use of such pipes has very much increased by the introduction of air-brakes, water and steam heaters, gas, etc., to say nothing of its prospective employment in car-frame construction. In view of all this, the following table, showing the sizes of threads and pipes, which appears to have been left out of the hand-books of the day, will be welcome to many readers:

down the veneer left untouched by the zinc until a thin shaving is taken off the portion forced into the walnut, when, the surface being perfectly smooth, the operation will be completed. It might be supposed that the result of this forcible compression of the two woods would leave jagged edges; but this is not the case, the joint being so singularly perfect as to be unappreciable to the touch; indeed, the inlaid wood fits more accurately than by the process of fitting, matching, and filling up with glue, as is practiced in the ordinary mode of inlaying.

The Cost of Iron.

The Philadelphia *North American* says: In the year 1850 the cost of making iron in Pennsylvania was $14.25 per ton, and in 1873 the cost had risen to $32.33. In 1851 the cost was but $13.30, and in 1853 it was $14.38. In 1854 commenced a rise in the cost to $16, which was followed in 1855 by $18.87, from which point the cost fell gradually to $16.14 in 1859, and as late as 1863 it was only $16.53. After that the inflation set everything wild. The items of this cost in ture, the heaviest items of cost have been the ore and the coal. In 1873 these two items cost $20.45 out of $32.33. There may, of course, be reasons why ore cost $13.30 in 1873 and $9.12 in 1864. But as in 1877 it had fallen to $7.69, there is room to suspect that the actual cost of producing the ore was not the real secret of the enormous rise. That the rapid increase of iron-works produced a competition for the ore there can be no doubt. And herein is seen the great advantages possessed by large corporations owning iron and coal mines, and limestone quarries. The general notion is that the excessive cost of labor raised the cost of all these things. The decline in the cost of ore is caused more by the large number of iron-works out of blast than by any actual retrenchment in the cost of raising the ore.

We refer to these figures now for the purpose of showing that the profits of iron-masters have been greatly misrepresented, and that when the price of iron was highest the margin of profit to the manufacturer was not excessive, nor indeed large. The demand for cheap coal had been answered as far as circumstances would permit; and yet the coal used by the iron fur-

TABLE OF THE DIMENSIONS AND OTHER PARTICULARS OF WATER, GAS, AND STEAM PIPES.

Inside Diameter.	Number of Threads per Inch of Screw.	Actual Outside Diameter.	Thickness. Ordinary Strength.	Thickness. Extra Strong.	Thickness. Double Extra Strong.	Actual Inside Diameter. Ordinary Strength.	Actual Inside Diameter. Extra Strong.	Actual Inside Diameter. Double Extra Strong.	All Strengths of Pipe. External Cirumference.	All Strengths of Pipe. External Area.	All Strengths of Pipe. Length of Pipe per sq. foot of outside Surface.	Ordinary Strength of Pipe. Internal Area.	Ordinary Strength of Pipe. Length of Pipe per sq. foot of inside Surface.	Ordinary Strength of Pipe. Length of Pipe containing one cubic foot.	Ordinary Strength of Pipe. Weight per foot.
Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Feet.	Inches.	Feet.	Feet.	Pounds.
⅛	27	0.405	0.068	0.100	.....	0.270	0.205	.....	1.272	0.129	9.44	0.0572	14.15	2500	0.243
¼	18	0.54	0.088	0.123	.....	0.364	0.294	.....	1.696	0.229	7.075	0.1041	10.50	1385	0.422
⅜	18	0.675	0.091	0.127	.....	0.494	0.421	.....	2.121	0.358	5.657	0.1916	7.67	751.5	0.561
½	14	0.84	0.109	0.149	0.298	0.623	0.542	0.244	2.652	0.554	4.502	0.3048	6.13	472.4	0.845
¾	14	1.05	0.113	0.157	0.314	0.824	0.736	0.422	3.299	0.866	3.637	0.5333	4.635	270	1.126
1	11½	1.315	0.134	0.182	0.364	1.048	0.951	0.587	4.134	1.357	2.903	0.8627	3.679	166.9	1.670
1¼	11½	1.66	0.140	0.194	0.388	1.380	1.272	0.884	5.215	2.164	2.301	1.496	2.768	96.25	2.258
1½	11½	1.9	0.145	0.203	0.406	1.611	1.494	1.088	5.969	2.835	2.01	2.038	2.371	70.65	2.694
2	11½	2.375	0.154	0.221	0.442	2.067	1.933	1.491	7.461	4.430	1.611	3.353	1.848	42.36	3.667
2½	8	2.875	0.204	0.280	0.560	2.468	2.315	1.755	9.032	6.491	1.328	4.783	1.547	30.11	5.773
3	8	3.5	0.217	0.304	0.608	3.067	2.892	2.284	10 996	9.621	1.091	7.388	1.245	19.49	7.547
3½	8	4.0	0.226	0.321	0.642	3.548	3.358	2.716	12.566	12.566	0.955	9.887	1.077	14.56	9.055
4	8	4.5	0.237	0.341	0.682	4.026	3.818	3.136	14.137	14.904	0.849	12.730	0.949	11.31	10.728

If we wish to estimate the effective steam-heating or boiler surface of tubes, the surface in contact with air or gases of combustion, whether internal or external to the tubes, is to be taken. For heating liquids by steam, superheating steam, or transferring heat from one liquid or gas to another, the mean surface of the tubes must be taken. All pipes of 1¼ inches diameter, or less, are butt-welded and proved to 300 pounds hydraulic pressure; 1½ inches in diameter and more, are lap-welded and proved to 500 pounds per square inch. It has been adopted to taper all threads, for the length of every inch, one-16th of an inch.

New Method of Inlaying.

A new method of inlaying wood, by which we should think very good results with but little labor may be obtained, has been contrived by a furniture manufacturing house in England. The process by which it is effected is as follows: A veneer of the same wood as that of which the design to be inlaid consists—say sycamore—is glued entirely over the surface of any hard wood, such as walnut, and allowed to dry thoroughly. The design is then cut out of a zinc plate about one-20th of an inch in thickness, and placed upon the veneer. The whole is now subjected to the action of steam, and made to travel between two powerful cast-iron rollers of 8 inches diameter by 2 feet long, two above and two below, which may be brought within any distance of each other by means of screws. The enormous pressure to which the zinc plate is subjected forces it completely into the veneer, and the latter into the solid wood beneath it, while the zinc curls up out of the matrix it has thus formed, and comes away easily. All that now remains to be done is to plane

1850 were: Ore, $5.75; coal, $3.70; limestone, 93 cents; labor, $2.22; interest, etc., $1.68. In 1860 these items had changed thus: Ore, $7.45; coal, $3.49; limestone, $1.21; labor, $1.87; interest, etc., $2.83. In 1873 the items cost thus: Ore, $13.30; coal, $7.15; limestone, $1.97; labor, $3.79; interest, etc., $2.76. In June, 1877, the cost of the same items was stated thus: Ore, $7.69; coal, $4.93; labor, $2.02; limestone, 81 cents; interest, etc., $2.81; total, $18.26.

From these figures it would seem that in the aggregate cost the manufacture of pig-iron in Central Pennsylvania had in 1877 returned to what it was in 1855, but not to what it was in 1860. The cost of ore was but little higher, but not nearly as low as in 1850. The cost of coal was higher; the cost of limestone was much lower than in 1860. Labor was lower than it had been in 1850 or 1855, but higher than in 1860. The interest, etc., was higher than ever. From these facts it appears that while we have made considerable progress in cheapening the cost of the manufacture of iron, there is still much to be done. Contrary to the general belief, labor seems to have returned to its ante-war standard, taking 1855 as a test. Limestone is cheaper than ever, and coal is not dear. The cost of ore might be slightly reduced. Whether coal can be cheapened to the iron trade is a grave question we are not prepared to answer. The item for interest, etc., in 1877 embraces $1.26 for interest on capital invested, and $1.65 for renewals, repairs, salaries, taxes, insurances, and sundries. In 1850 the corresponding cost was only $1.68, and in 1864, in the midst of inflation, it was $1.66. Evidently this item has not been retrenched at all, since in 1873 it was $2.76, and in 1877 it was $2.91.

In all the history of the Pennsylvania iron manufac-

naces was $4.93 per ton in 1877, while in 1860 it cost only $3.49. In 1871 the same coal had reached $8.59, and in 1873 it had fallen to $7.15. Of course the labor question enters into all these items of coal, ore, limestone, and iron manufacture at every stage. But at the highest point of inflation the cost of labor in making a ton of iron had only reached $3.54, while in 1855 it was $2.87. Coal was then (1855) $4.63 per ton. Those iron-masters who realized large fortunes in the trade did so by combining more than one branch of the business, and making profits on all. Iron was for a series of years in immense demand all over the world, but especially in this country. Protection enabled manufacturers to maintain themselves against a heavy foreign competition, and to attract large amounts of capital to develop all the advanced forms of the iron industry. Those who now so constantly demand cheaper iron must be aware that in order to meet that demand, the items of cost must all be reduced more and more, whether the cheap iron be furnished by foreign or domestic producers. If we can cheapen our own cost advantageously, of course it should be done. And it is important to observe that thus far the cheapening has been wholly caused by domestic competition. Cheap iron is desirable at all times. That fact must never be lost sight of. But in order that the cheapness should be enduring, it is indispensable that the domestic production shall not be crippled.

BEHM AND WAGNER'S TABLES have lately been published, and show a total increase in the population of the earth of 15,000,000, partly arising from natural growth, and partly from the showings of new and more exact censuses.

Object Teaching.

CONTINUED FROM PAGE 19.

The series of objects represented in Fig. 1 is called a second gift to the child. These objects are of a different character from the first series; the latter were soft, light, round, and soundless; those now described are hard, heavy, resonant, and some of them angular. They are a wooden ball, cylinder, and cube. The first thing to be done is to have the child attentively observe how the ball will roll in all directions, the cylinder only in two, while the cube will not roll at all; let the child also observe how the cube can be cut

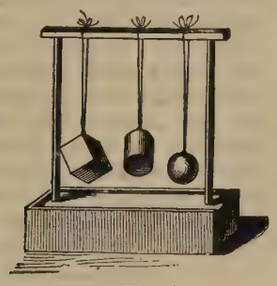


Fig. 1.

down into a cylinder, and the cylinder, by the further taking away of material, into a ball. In this way an early opportunity is given for comparison, exercising the faculty of noting differences, and also the reasoning faculty. The ball is at once recognized as an old acquaintance in regard to form; the cube and cylinder are new, the cylinder being intermediate between the cube and the ball, which are the opposite. The child's attention is to be called to this; for instance, the sphere has only one surface, with no corners; the cube has six surfaces or faces, eight corners, and twelve edges; the cube therefore is immovable, while the ball and cylinder will roll. The cylinder has three

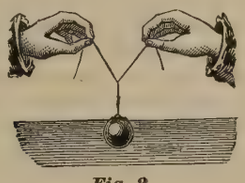


Fig. 2.

surfaces, two flat round ones and one curved surface; it has no corners, but has two circular edges.

An exercise with the wooden ball is represented in Fig. 2, when the sound it makes on the table will amuse the child, as it is well known that children delight in anything that impresses their sense of hearing.

The exercises with the cube are represented in Figs. 3, 4, 5, 6, 7, 8 and 9; laying it flat on its side (Fig. 3), when it has stability; putting it on its edge (Fig. 4), when it will tip over, except when placed with its side leaning against something; in Fig. 5 it is attempted to place it on one corner, and it is shown how it can be made to turn upon the lower corner by supporting the upper corner with the finger.

In Fig. 6 the cube (of which there are two, one pro-

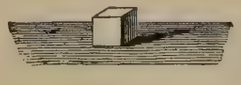


Fig. 3.

vided with hooks, to which to attach threads, and also perforated in straight and diagonal directions) is suspended to a thread and used as a pendulum, and the child is made to observe how it swings quicker or slower, in proportion as the thread by which it is suspended is made shorter or longer.

In Fig. 7 is represented the way in which a stick is passed straight through its center, and the cube turns on an axis like a top. In Fig. 8 the stick is diagonally passed through, and the cube also rapidly turns on its axis, while the child is made to observe the cylindrical form shown when whirled around, as in Fig. 7, and the different forms it shows when whirled around when arranged as in Fig. 8.

The position of Fig. 9 is intended to let the child count how many faces of the cube can be seen at once, how many edges, and how many corners. The child soon finds out that in certain positions only one face

Fig. 4.

can be seen, in other positions two, and never more than three at the same time.

In Fig. 10 the ball is suspended in a support by a short string, while the motion of a bell is imitated.

For all these exercises plain rhymes have been composed, which the children may sing during the various exercises. For the last one the rhyme is as follows:

Bell so high
In the steeple,
Calling "Come to church, good people;"
Loudly ring,
And sing your song,
Ding-dong-ding, ding-dong, ding-dong.

Similar appropriate rhymes are found in the "Kindergarten Guide," by Maria Kraus-Bœlte and John Kraus, published by E. Steiger, New York, which we earnestly recommend to mothers who want to occupy their children in a proper way, as well as to teachers

Fig. 5.

of very young children, even if they do not keep Kindergartens.

The Pedomotor.

A contrivance for accelerating man's pedestrian powers is thus described in the Philadelphia *Record:*

"The newspaper carrier who serves papers to the attendants in the Permanent Exhibition building, goes all his rounds at the rate of twelve miles an hour. He travels on machinery not unlike roller skates, which are called pedomotors. According to the inventor, Mr. J. H. Hobbs, an architect, the day is not far distant when the whole city will be on wheels, when pedestrians will be skimming through the streets at the rate of ten miles an hour, without any more effort than

Fig. 6.

is now put forth in perambulating half that distance.

"The pedomotor consists of four tough, light wooden wheels, supplied with an outer rim of tough India rubber. These wheels are secured to a frame the shape of the foot, which is strapped to the pedal extremities in the usual manner. Unlike roller skates, the wheels of these little vehicles are not under, but are placed on each side of the foot, thus giving the wearer a good standing, as well as a solid footing. The rear wheels

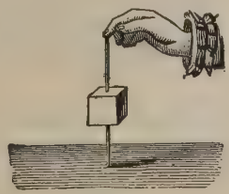


Fig. 7.

are 3 inches in diameter, while those in front are but 2½ inches. This gives the foot a slight incline, and when in motion has much to do in impelling the pedestrian forward. Extending from the toe, with a slight curl toward the ground, is a piece of casting termed the 'pusher,' which is simply used in mounting an elevation or steep incline. From the center of the heel a small brass wheel extends backward, serving as a guide as well as a brake. The whole contrivance scarcely weighs a pound. In using the pedomotors no more effort is required than in ordinary walking. The wearer steps with his regular strides, and is amazed to find himself skimming over the ground so rapidly with so little muscular effort. The inventor explains the mystery of the rapid movement in this manner: A man whose stride is 32 inches will traverse 48 inches, or one-half further with the pedomotor. This is because the body is in constant motion. For instance, he says, the traveller starts, and, while he raises one foot to

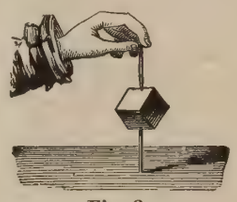


Fig. 8.

step, he continues rapidly onward until that foot is set down and the other raised to make another step. This gives him more momentum, and away he goes over a mile and a half in the same time it would take him to accomplish one with the feet. No effort of the body is required for their use, as in skates. The traveller simply plants one foot before the other, and finds himself whizzing along at a lively rate."

We think that this inventor labors under the same difficulty that so many other inventors do, namely, overestimating the advantages and entirely leaving out of sight the drawbacks. One of the latter is that the arrangement can only be used on smooth and clean horizontal roads; on rough or muddy roads the wheels on the feet would be a regular nuisance, while on inclined roads it would be very fatiguing to roll upward,

Fig. 9.

and for downward travel he has omitted to supply a brake. That no effort would be required, as in travelling on skates, is erroneous—in fact, the propelling force is the same, one foot must push backward so as to move the other forward. Finally, the claim that the front wheels of the little wagon placed under each foot, being smaller than the rear wheels, constitute a downward incline for the foot, and will propel the traveller forward, is downright nonsense. If this were so, carriages with small front wheels would scarcely need any horses to pull them; on the contrary, experience proves that the easiest pull is obtained when

Fig. 10.

the axes of all the wheels are on the same level with the direction of the pull.

ILLUMINATED CLOCKS.—Herr Reiniger, of Stuttgart, has suggested that small towns may secure at slight cost the advantages of an illuminated clock by making the same use of the powers of the magic-lantern that modern advertisers have learned to appreciate so well. The image of a clock-face and of the moving hands can be easily thrown upon a prepared surface, so as to be distinguishable at a considerable distance in spite of the grayness of the images of hands and figures. To produce such an illuminated dial it would probably be necessary to make use of one of those clocks called by the French *pendules mystérieuses*, which are to all seeming naught but a glass dial and a pair of hands, but about the accuracy of their movement there is much reason to doubt.

Dangerous Method of Connecting Steam-Boilers.

We continue our series of articles from the report of the Hartford Steam-Boiler Inspection and Insurance Co., of Hartford, Conn., by noting a very dangerous method of setting and connecting boilers where two boilers are provided with only one safety-valve, and yet each boiler is provided with a "stop-valve," that is, valves so situated that either boiler can be shut off when not in use. The danger here is that when the idle boiler is put into use the attendant will forget or neglect to open the stop-valve, and, there being no outlet to the *one* safety-valve, the pressure increases until the surrounding metal is unable to resist the internal pressure, and an explosion occurs. Boilers should in no case be set in this way unless each boiler is provided with its own safety-valve, located on the shell of the boiler. We have known of several very serious accidents arising from this style of fitting. A case occurred during the past year. The owners of the boilers were substantial men, and had no idea of the responsibility which they incurred. Their attention was called to the danger, and they evidently intended to give it early attention, but failed to do so, and a serious disaster followed.

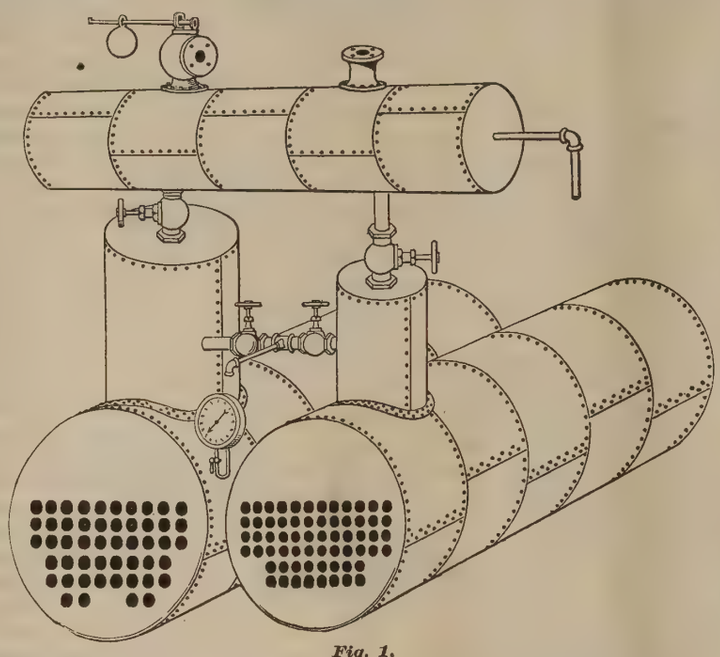


Fig. 1.

Fig. 1 shows the original condition of the boilers, with steam-drum on top. It appears that for some reason one boiler had been shut off, and the steam-gauge between the boilers had been removed for repairs. The boiler was fired up, and a destructive explosion occurred. Fortunately no lives were lost. There are many boilers through the country set in this way, and serious accidents have occurred and will occur so long as this practice is followed.

Portions of the boiler were thrown from 300 to 700 feet. The adjoined engravings will show the manner in which the iron was torn. Fig. 2 represents the top of the drum after it was torn off from the lower portion. Fig. 3 is the rear end of the left-hand boiler; it was thrown a distance of 225 feet; while Fig. 4 shows the front end of the same boiler, which remained in its place, but was badly torn up.

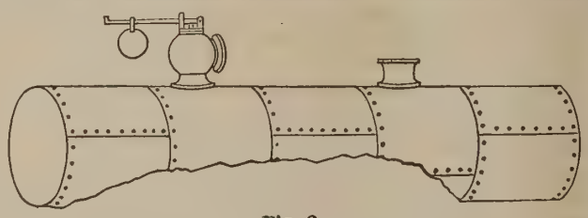


Fig. 2.

Cloth from Pineapple Fiber.

Seeing that the fine white fibers of pineapple leaves are convertible into the most delicate fabrics, it is rather surprising that their utilization should be so restricted in countries where the *Ananassa sativa* grows in abundance. In the Bahamas and Azores the cultivation of the pineapple is encouraged simply for the sake

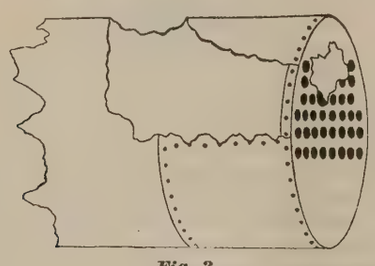


Fig. 3.

of its luscious fruit, and no attempt is made to turn the fibers to profitable account. In Malacca and Singapore —less productive habitats of the pineapple—it is otherwise, however, and the preparation of the fibers for exportation to China, where they are manufactured into cloth, is becoming quite a business. The process of extracting and bleaching the fibers is exceedingly simple. The first step is to remove the fleshy or succulent side of the leaf. A Chinaman astride on a narrow stool, extends on it in front of him a pineapple leaf, one end of which is kept firm, being packed beneath a small bundle of cloth on which he sits. He then, with a kind of two-bladed plane of bamboo, removes the succulent matter. Another man receives the leaves as they are planed, and with his thumb nail looosens and gathers the fibers about the middle of the leaf, which enables him by one effort to detach the whole of them from the outer skin. The fibers are next steeped in water for some time, after which they are washed in order to free them from the matter which still adheres and binds them together. They are now laid out to dry and bleach on rude frames of split bamboo. The process of steeping, washing and exposing to the sun is repeated for some days until the fibers are considered to be properly bleached. Without further preparation they are sent into town for exporation to China. A simple, cheap machine, capable of taking the place of manual labor in the extraction of the fiber, would, without doubt, encourage this industry, and add to the cultivator's profits.

Planing-Machine for Granite.

The Boston *Advertiser* for January 2d, contains, under the head of "Granite Planed Like Wood," an article on a new machine for planing stone rapidly, built on the principle of the wood-planing machine. The article begins by saying that when swiftly revolving knives were first made to do the work of horizontal planes upon plank and board, great wonder was expressed, and the planing-machine came at once to be the talk of town and country. We have all become used to that and see no impracticability in the use of steel vs. wood in the rapid displacement of the rough surface of the latter. Next in order one might reasonably expect that some ingenious man would devise a method for the cutting of soft stone, such as freestone, sandstone, and the like, but that chisels or tools of any sort that could be made, would, when driven, dull quickly, and render the operation practically of little value. Such a plan for the cutting of marble could not be entertained, for the hard material must be removed by well directed strokes from a powerful arm. The inventor of the above mentioned machine has now shown what may be accomplished. Disdaining, as it were, to meddle with softer substances, he selects for the test of his invention the hardest of all—granite, and the hardest granite at that—Hollowell. Easily and simply as the surface is removed from a pine board and caused to fly off in chips, the flinty roughness is made to leave the face of the great block, and only a fine powder remains to prove that a strange work has been done by the ingenious application of steel. "If there could be made a tool that would not require constant watching and very frequent sharpening, you might plane granite," said a practical granite cutter. The inventor showed him that for forty-five minutes his machine could run continuously and the tools be uninjured, and he was not a little surprised to note the amount of work done by the machine in that short space of time. The tools can be changed in a few minutes, and the whole machine at once put into operation.

Mechanics the Tenth Muse.

Mr. S. S. Cox, lately delivered a lecture in Chickering Hall, New York, in which he claimed that the art of Mechanics ought to be classed as "The Tenth Muse." He claimed that it was entitled to this distinction, and proceeded to give his hearers the poetry of science. This, he said, was an age of steel—he meant Bessemer steel—and then gave an account of the marvelous progress that had been made in this country in the development of iron and steel manufactures. He referred to the poetic conception of the pendulum, and showed what marvelous mathematical consequences depended upon its movement. Important as man was, he was entirely useless unless he was supplied with the requisites for the development of mechanical industry in the shape of tools. Carlyle had emphasized this by saying that man was but a two-footed animal. While it was true that mechanics were indispensable to the full development of progress, man was also in himself a perfect mechanism, and all that was developed in nature might be found in him. What an astonishing power there was in the jaw of man; he did not mean as it was developed in Congress, but in the ordinary occupations of life. If they would study

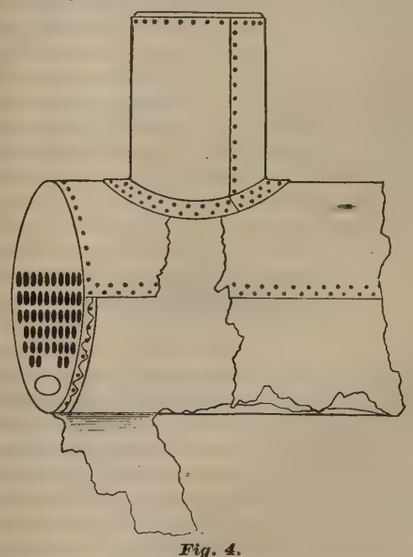


Fig. 4.

the mechanism of it they would be astonished at its wondrous adaptability for the work it had to do. The lecturer then turned to the consideration of the mechanism of the female form and its wondrous beauty. He said love glances used up a very large amount of

caloric in the human system, and that its place must be supplied by wholesome bread and butter. He then commented upon the various theories of light, and said he had known two bright lights to produce darkness, and had particularly noticed this effect in Congress. The lecture was closed with a summary of what had been achieved by steam and by electricity, and a graphic portrayal of what the future would develop in the improvement and the capabilities of the telephone and the phonograph.

Instantaneous Phenomena Recorded by Photography.

One of the most recent applications of instantaneous photography was the production of pictures of horses in motion, at different rapidly succeeding instants of a trot or galop. This was accomplished by a series of cameras, each of which took a picture in rapid succession within small fractions of a second, as described by us on page 186 of our August number for 1878.

The same process has been recently applied by General Abbott for recording the effects of explosions at different instants of their occurrence. However instantaneous an explosion appears to take place, it occupies, notwithstanding, a measurable amount of time, while the methods which can be applied in modern photography give pictures in periods of time much shorter still. General Abbott concluded to make such a series of pictures of the different stages of the explosions of submarine torpedoes, and in order to make six pictures, he had a key-board constructed like that of a piano, consisting of seven keys. The pressure of each of the keys closed a circuit; that of the first key went to the torpedo and exploded it; the remaining six keys were each connected with a fuse, which sustained by a thread the screens of six cameras, prepared to take pictures of the explosion. Any of these keys, when touched, ignited the fuse, which disrupted the thread and dropped the screen; in the latter was a hole, passing before the objective of the camera, giving, during that passage, an exposure of which the time was estimated to be at most the one-20th of a second. If, now, the keys of this key-board were rapidly played, like a pianist playing a scale on a piano, all the seven keys could be touched in succession, in any previously determined velocity, always giving first the explosion itself, and then the exposure of its effects in the cameras in successive periods of tenths of seconds, or more or less, as desired.

The first experiment was with the explosion of 500 pounds of dynamite, estimated equal to 5,000 pounds of gunpowder, and the pictures taken at intervals of one-10th of a second, so that all the successive pictures were taken in not much more than half a second. This is not even a very rapid succession, as almost any pianist can easily play twice as many successive keys in that time. The result was an exposition in the pictures of all the successive results, analyzed and in order. Among other curious effects, the photographs showed that a plane horizontal force was developed by the explosion.

Other experiments showed that depth was an important factor. Two torpedoes were exploded near together, one 3 and the other 6 feet deep; the first threw up a column of water twice as high as the latter. To ascertain how a torpedo affected a hull, or broke up a ship, two charges of 50 pounds each were placed 3 feet under the bottom of a hull. The eye saw nothing but a confused outburst of water, by reason of the persistence of images on the retina; but the photographic camera was very much quicker than the eye, as proved by the series of photographs, which showed the whole manner in which the hull yielded to the shock, the shape and position of the different fragments while flying up in the air and coming down again. All this was distinctly pictured in the series of photographs; still from the time the torpedo was fired until the pieces had come down, only about 2 seconds elapsed, while in 4½ seconds the water where the vessel floated was quiet again.

Microscopic Eye-Pieces.

The eye-piece of a microscope serves the same purpose as that of a telescope, namely, to enlarge the image of the object thrown by the objective glass in the interior of the tube. The telescope forms a small image of a large, distant object in or very near the focus of its objective, while the microscope forms an

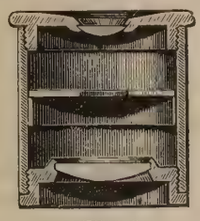


Fig. 1.

enlarged image of a small object placed very near to its objective, at a great distance beyond its focus; and in both cases the eye-piece serves to enlarge this image and see it as distinctly as if we saw the object itself. Hence the most simple microscopes and telescopes have

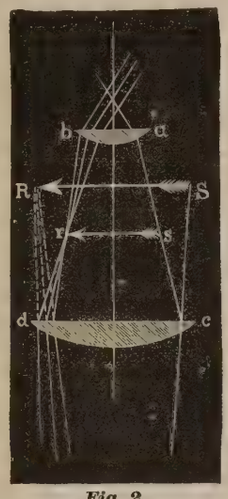


Fig. 2.

only two glasses; one called the objective, as it is turned toward the object under examination, whether it be a planet observed by the telescope or a blood-cell examined by the microscope; the other glass, called the eye-piece or ocular, is turned toward the eye which looks into it, and then sees the planet as if it were

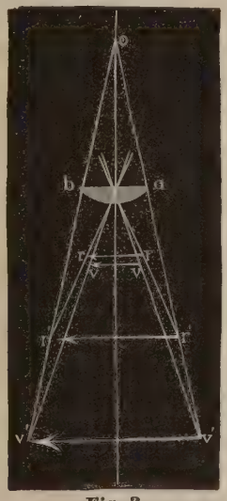


Fig. 3.

much nearer to the observer, or the blood-cell as if it were much larger. Such a telescope or microscope, consisting of only two glasses, is very imperfect, giving distorted and unnaturally colored views of the objects, hence double glasses are used—double objectives made of two kinds of glass, flint and crown, which, if well made, give correct images, and double eye-pieces, which do not distort and discolor the image, as is the case when using a single lens. We will here describe the eye-piece as now used for the microscope.

Fig. 1 represents its interior arrangement; it has a small lens of crown glass on top where the eye looks into it, and a larger lens (also of crown glass) at the bottom, with a diaphragm between, which shuts off all light, which would fall sideways and illuminate the tube. The latter, for further security, is blackened inside, so as not to disturb the distinct view of that which has to be observed.

In this eye-piece the lower large lens serves to correct the distortion, not only of the objective, but also of the upper lens. The objective does not form the image in such a way that it lies on a plane surface, but in a spherical curve, of which the center is in the objective, consequently the outside edges of the image are at a greater distance from the eye-piece than the center is, and this interferes with the distinct vision, as for the latter the whole of the image must lie in the focus of the eye-glass. This now is corrected by the lower lens, which properly belongs to the objective, but is almost always inserted in the same tube with the eye-glass. The way it operates is represented in the diagram, Fig. 2, in which R S represents the image as it would be formed by the objective if the lower lens *d c* were not present; this lens being convex makes the rays convergent, and the image will be formed in *r s*. This image is now observed by the lens *a b*, which is properly the only eye-piece. The lens *c d* is called the collective lens.

The rule for the focal length and distance of these lenses is that if the focal length of the lens *a b* is 1, the distance of the two lenses must be 2, and the focal length of the lower or collective lens *c d* is 3. This combination is called after its inventor Huyghens, the Huyghenian eye-piece, and is used in telescopes as well as in microscopes.

It is evident that the magnifying power depends as much upon the eye-piece as upon the objective; however, as a rule, an eye-piece of moderate power is the most available; those of greater power, only stretch the image out more without enabling the observer to see further details. The latter depends upon the objective, and it is only objectives of superior quality that can stand the use of strong eye-pieces, while, in order to attain high magnifying powers, nothing but objectives of very short focus are available.

The advantages of this double eye-piece become more evident when we consider the action of a single lens. Let us suppose (which is very nearly the case) that the image *r s* is exactly in the focus of the eye-glass *a b*, then it will also be exactly between the two lenses, as their distance is twice the focal length of the lens *a b*. As the focal distance of the collective lens and the distance of the image *r s* from the same, are known quantities, it is easy to calculate where the image R S must be situated, being always formed at the point where the rays, coming from the object, cross one another before they pass to the eye-glass. The calculation shows that R S is about half way between the lens *a b* and the image *r s*. Hence the distances of the images *r s* and R S from the collective glass is as 1 : 1.5, therefore the image R S is 1½ times as large as *r s*.

If now we want a lens wherewith to see the image R S just as large as we see *r s* through the eye-piece *a b*, then the focal length of this lens must be 1½ times as large as that of *a b*, and ½ times as large as that of *c d*, namely, in order to obtain with a simple lens the same magnifying power that is obtained by the double Huyghenian eye-piece, the focal length of this lens must be half that of the collective lens *c d*, which therefore may have twice as large a diameter as the lens equivalent to the Huyghenian eye-piece. By the same magnifying power, therefore, the Huyghenian eye-piece gives twice as large a field as a simple lens. A further advantage consists in the fact that such a double lens gives an image that is almost entirely free from chromatic aberration. This we will now explain by Fig. 3.

As the collective lens is not achromatic, it forms a series of images of the object, of which (as the blue rays are the most and the red rays the least refrangible) the blue image lies nearest to the lens and the red

the furthest, wherefore also the blue image is the smallest. In Fig. 3 let *r r* be the red, and *v v* the violet or blue image of the object. If we look at these images by the eye-glass *a b*, they are seen magnified, and apparently situated respectively in *r' r'* and *v' v'*. These images, however, are situated in such a way that they become superposed or united for an eye in *o* looking down through the eye-glass *a b*, and so it is that the rays of different colors which leave an object and are at first separated by the lenses, and in this way pass through the microscope, finally reach the eye in such a manner that they come together on the retina of the eye.

Scientific.

SELF-LUMINOUS CLOCK-DIALS.—In our March number for 1878, (page 67), we suggested the use of the sulphids of calcium, barium, and strontium for wall-paper, as these substances, after previous exposure to light, continue to shine in the dark, with a soft phosphorescent glow, and after slowly diminishing in luminosity, can be excited again by a short exposure to daylight, or, in the absence of this, and also better, by a short exposure to the light of an electric spark. As the substances named glow with different colors, it is even possible to make paper with figured patterns printed with various phosphorescent substances, producing a variety of colors in the light they emit, which would make this particular kind of illumination of a room by night, ornamental as well as useful.

A first step in this direction has been taken by the manufacturers of the self-luminous clock-dials which have been recently introduced in the market. They are coated with the sulphid of calcium; but a peculiar method has been followed in its preparation, which appears to be the secret of the manufacture, making the sulphid of calcium with which these clock-dials are covered more luminous than the ordinary preparation of this kind, while the luminosity also lasts longer, and requires less light to excite it than this substance, when prepared according to the known method.

The curious behavior of the substances named may be compared with the resonance of sound by the sounding-board of a piano when the dampers are lifted up. The sound does not cease after the hammers have struck the strings, but goes on and slowly dies away, as the vibration generated in the sounding-board by the strings continues for a longer or shorter time, and, being transmitted through the air, produces a continuous sound. In the same way, the vibrations of which light consists, find in the phosphorescent substances named a material which not only reflects these vibrations and becomes visible, as is the case with most other substances, but the particles themselves are put into vibration, and even continue these vibrations after the exciting rays of light have ceased, even as the piano sounding-board referred to continues its vibration.

This explanation is based on Huyghens' undulatory theory of light, now generally adopted, and as this phenomenon cannot be so well explained on the basis of the emission theory of Newton, it is another argument in favor of the former theory.

Prof. H. Morton, of Hoboken, N. J., in speaking on this subject in the *Journal of the Franklin Institute*, goes a step further than we do, and proposes not only to cover the walls of rooms with such substances, but also the outside of houses, by which the need of street lamps would be obviated, as the house fronts would during the day absorb light enough to shine during the night, rendering all sources of artificial light unnecessary, including the electric light, in regard to which such high expectations are entertained and such dazzling conjectures indulged in.

Prof. Morton says with good reason: "If conjectures are the order of the day, I do not see why this conjecture (about the self-luminous walls) is not as good as many others which have been made. If further advances are made in this direction, it is easy to imagine some very wonderful results, before which even Mr. Edison's new electric burner will fade into insignificance."

We fully agree with him in the opinion that the phosphorescent sulphid of calcium, made as it is of very cheap materials, (calcined oyster-shells and sulphur), is a truly wonderful substance, which justly suggests strange possibilities for the future.

SPECTROSCOPIC TEST OF BLOOD WHILE IN THE HUMAN BODY.—The compound which oxygen makes with the coloring matter of blood—namely, oxyhæmoglobin—gives a well-marked spectrum having two absorption bands. Herr Vierordt, a German physiologist, has pointed out that this may be simply observed by putting the fourth and fifth fingers one over the other, and bringing their line of union before the slit of a spectroscope, the light used being sunlight transmitted. If now a caoutchouc ring be passed around the fingers so as to stop the access of arterial blood, the two absorption bands in the spectrum disappear in a few minutes, the spectrum giving place to that of reduced hæmoglobin. Take the ring off, and the former spectrum recurs. These phenomena evidently give information in regard to the rate at which oxygen is being used up in the human body, and might, Herr Vierordt thinks, be advantageously utilized by physicians. To this end, he goes on to show that even reflected light will give the indications, and they can be conveniently observed from a finger, the red part of the lips, the tongue, red cheeks of young persons, etc., with a Browning spectroscope. The observer notes exactly the moment at which, say, a caoutchouc ring is applied to the finger and the moment of disappearance of the bands. The latter may seem vague, but with practice a sufficiently exact judgment may be formed. Vierordt gives a detailed account of the changes that occur. Without here following him in this, we note the results of a large number of experiments made on himself between the 7th of May and the 3d of July. The amount of consumption of oxygen then in normal, quiet life, is found to show considerable variations, (as much as nearly threefold). Immediately on rising out of bed, the process is slowest—about 4 minutes 5 seconds on an average. The muscular exertion in dressing and washing increases it somewhat, (it was 4 minutes 42 seconds), and it becomes much quicker in the next half hour, (2 minutes 35 seconds), doubtless partly due to breakfast. The values then are pretty constant till after the mid-day meal. Immediately after this it rose, (2 minutes 10 seconds), and one hour later—at 2 o'clock—reached a maximum, (1 minute 24 seconds). Then comes a gradual decrease, till, between 6 and 8 o'clock, something like the value in the forenoon is reached again. Supper gave, in the only two cases observed, a considerable rise, (1 minute 36 seconds).

Various occupations had a marked influence on the phenomenon; thus, continuous speaking always increased the consumption of oxygen; so did sundry other bodily movements, such as walking, etc. Specially interesting was the increase in consumption observed during a temporary indisposition of the experimenter. Shortly before and during the ailment low values were had; but as he grew better the values rose again. By intensifying his breathing he could considerably increase the time in which the absorption bands disappeared. It is notable that the dissociation of oxyhæmoglobin occurs in about two minutes—that is, about the time in which suppression of breathing is found to cause the greatest phenomena in the system.

SOLIDIFIED HYDROGEN, OR HYDRIUM.—The success at last obtained in liquefying the gases thus far supposed to be permanent, has already been described by us, and it appears certain that not only liquefaction but also solidification has been achieved.

Pictet, in a very recent experiment with hydrogen compressed at 650 atmospheres, found, on opening the stop-cock, that the gas issued with a noise like that of a hot iron bar under water, and it had a steel blue color. The jet suddenly became intermittent, and then there followed a sort of hail of the solid particles of hydrogen, which fell with violence on the ground and produced a crackling noise. Afterward the stop-cock was closed, and there was evidence that a crystallization of hydrogen took place within the tube; but when the temperature was again raised, the gas issued as a liquid. M. Dumas, the President of the French Academy of Sciences, accepts these facts as full of confirmation of the theory, long ago advanced, that hydrogen is a gaseous metal. As water is an oxid of hydrogen, it follows from this that when a person drinks a glass of water, he imbibes a metallic oxid. *Nature*, in mentioning these performances, copies with them another, which it regards as yet more remarkable from a scientific point of view. M. Pictet has been able to measure, with a very close approach to accuracy, the volume occupied by a given weight of oxygen in the liquid state; this was found to agree with the volume calculated for the solid or liquid gas, on theoretic considerations, by M. Dumas. By means of two Nicol prisms, M. Pictet observed the jet of liquid oxygen in polarized light, and found strong evidence of the presence of solid particles.

As in the chemical nomenclature the final ending "um" has been adopted for all metals, it is proper to call this metallic hydrogen, "Hydrium," a name which has already been used by the latest authors of German text-books of chemistry, even before hydrogen had been liquefied or solidified.

ELECTRIC-SPARK PEN.—A new invention in the art of engraving, probably suggested by the familiar electric pen, has been brought out in Paris. A copper plate is prepared as for engraving, and over this is secured, in some convenient manner, a thin sheet of paper. The plate is then connected with one pole of a Ruhmkorff coil. The pen (presumably a simple insulated metallic rod or pencil with a fine point) is also connected, by means of an insulated wire, with the coil. Then, if the point of the pen (which is bare) is touched to the paper, a minute hole is burned in it by the spark that leaps from the point of the pen to the plate. By using the pen as a pencil, a drawing may be made on the paper in a series of fine holes precisely after the manner of the electric pen, except that in one case the holes are mechanically punched out, and in the other case are burned out. When the drawing is finished, the paper may be used as a stencil. A printer's roller carrying an oily ink is passed over the paper, and the ink penetrating the paper through the holes, reproduces the drawing in ink on the copper plate. The paper may then be removed and the plate submitted to an acid bath, when the surface will be cut away, except where the ink resists the acid, and those parts will be in relief, thus producing an engraved plate ready for the printing-press. By this ingenious device, the artist, drawing upon the paper with the spark-giving pen, performs two operations at once—drawing the picture and engraving the plate.

RESULTS OF AËRIAL NAVIGATION.—Mr. E. C. Stedman, the poet, writes in the Mid-winter *Scribner* on this subject, which he confesses to be his hobby. The paper is in a half humorous, half serious tone, but discusses practically the causes of failure heretofore, and the desiderata of final success. Mr. Stedman speaks thus buoyantly of some of the ultimate results of aërial navigation:

"Not only by their processes of construction, but also by the power and freedom gained through their success, a delightful reflex influence will be exerted upon the æsthetics of life. Poetry and romance will have fresh material and a new *locale*, and imagination will take flights unknown before. Landscapes painted between earth and heaven must involve novel principles of drawing, color, light and shade. Music, like the songs of Lohengrin, will be showered from aërial galleys. In every way the resources of social life will be so enlarged that at last it truly may be said, 'existence is itself a joy.' Sports and recreations will be strangely multiplied. Rich and poor alike will make

of travel an every-day delight, the former in their private aëronons, the latter in large and multiform structures, corresponding in use to the excursion-boats of our rivers and harbors—the 'floating palaces' of the people, and far more numerous and splendid. The ends of the earth, its rarest places, will be visited by all. The sportsman can change at pleasure from the woods and waters of the North, the run-ways of the deer, the haunts of the salmon, to the pursuit of the tiger in the jungle or the emu in the Australian bush. An entirely new profession—that of airmanship—will be thoroughly organized, employing a countless army of trained officers and 'air-men.' The adventurous and well-to-do will have their pleasure yachts of the air, and take hazardous and delightful cruises. Their vessels will differ from the cumbrous aërobats intended for freight and emigrant business, will be christened with beautiful and suggestive names—Iris, Aurora, Hebe, Ganymede, Hermes, Ariel, and the like—and will vie with one another in grace, readiness, and speed."

Mr. Stedman also reproduces memoranda and drawings made by him several years ago, embodying, as he thinks, the true principle of air-travel, the progress of which is reviewed by him with hopeful prophecies of success in the near future. Of his own speculations, he says: "To use the patent agent's phrase, 'what I claim' as my invention rests upon the following basis: 1st. Model in nature, with respect to shape, motion, power and buoyancy—the fish. 2d. The unity, integral quality, freedom from external impediments, of the whole structure; and therefore, 3d. Rigidity and compactness of its architecture. 4th. Buoyant equipoise; with preservation of the contents of the aërostat."

Motion by Permanent Magnets.—When a large, very thin iron disk is placed horizontally, and made very easily movable upon a vertical axis passing through its center, it can be made to revolve by placing the opposite poles of magnets near its circumference, or by embracing it between the poles of a horse-shoe magnet. All that is required is to heat the disk by a spirit lamp at a point just beyond one of the poles; the rise of temperature will then diminish the attractive force of the magnet at this part of the disk, and this part consequently will turn from the magnet, its diminished attraction being overcome by the stronger attraction of the magnet on the cooler portion of the disk. When the diagonally opposite part is heated at the same time and in the same way, the motion is more rapid. It is evident that this motion can only be slow, as the varying parts of the disk can only be slowly warmed and cooled. This alternate warming and cooling could be promoted by placing pieces of ice under the disk, between the lamps and the pole toward which the disk is moving, the ice extending to the next pole, so as to keep the part to be attracted as cool as possible.

It will be seen that this motion is based on the principle that magnetic attraction is influenced by temperature, in such a way that it decreases by heat and increases by cold. It is well known that iron at about 1,000° entirely loses its property of being attracted by a magnet. Nickle loses it at 450°, and manganese at the common temperature, so that if cooled artificially it will be attracted. It is, therefore, likely that a plate of nickel would be better than one of iron, as it does not take as much heat to diminish its magnetism as it does that of iron. If, however, this advantage would not be counterbalanced by the fact that iron is attracted with more force than nickel, is a question to be settled by experiment.

Uranine.—This is the most recently discovered, and perhaps the most remarkable, of all the coal-tar or anilin group of coloring substances, now so extensively used for the adornment of the finest fabrics. Uranine is said, by chemists, to be the most highly fluorescent body known to science. Its coloring power is astonishing; a single grain will impart a marked color to nearly five hundred gallons of water.

A most interesting experiment, which anybody may try, consists in sprinkling a few atoms of Uranine upon the surface of water in a glass tumbler. Each atom immediately sends down through the water what appears to be a bright green rootlet; and the tumbler soon looks as if it were crowded full of beautiful plants. The rootlets now begin to enlarge, spread and combine, until we have a mass of soft green-colored liquid. Viewed by transmitted light, the color changes to a bright golden or amber hue; while a combination of green and gold will be realized, according to the position in which the glass is held. For day or evening experiment nothing can be prettier than these trials of Uranine, which are especially entertaining for young folks. We are indebted for examples of the color to the editors of the *Scientific American*.

Another Explosive.—Nobel, the inventor of dynamite, is reported to have devised a still more powerful explosive. Its composition is 93 to 94 per cent of nitroglycerin, and 6 to 7 per cent of collodion cotton. It is tough, but may be made into cartridges, cakes, or balls, and may easily be cut with a knife or scissors.

Quantitative Analysis of White Light.

It has for a long time been a problem waiting for experimental decision, to determine accurately the relative intensity of light in the different parts of the solar spectrum. The prism splits up a ray of sunlight into its component parts, the colors it analyzes, qualitatively, but the question to do it quantitatively is an open one, as since Newton no definite inquiries have been made, but only estimates which usually stated that in the yellow light there was the greatest quantity, and in the violet the least. Prof. Rood of Columbia College, New York, has recently taken the subject up, and first tried to ascertain the dividing line between the neighboring colors, attempting, for instance, to determine definitely where red ceases and orange begins, and so for all the colors. Prof. Rood thinks that definite standards of color can not be denied, and that artists agree in this, but if we consider the very gradual shading of the spectrum so that the colors blend imperceptibly one in the other, and remember the fact that the impression of color is subjective, and not objective, that means depends greatly upon the individual who judges about the colors, it is evident that the determination of the limits must differ in the individuals, and Prof. Rood's determination of the limits would be more reliable and subject to verification if he had taken as his limits certain spectral lines, of which there are enough to serve any purpose of division. Having divided the spectrum into 12 parts, he multiplied the space occupied by each part, with the relative intensity or luminosity, when he obtained the following results: red, 54; orange red, 140; pure orange, 80; orange yellow, 114; yellow, 54; greenish yellow, 206; yellowish green, 121; green and blue green, 134; Prussian blue, 32; blue, 40; ultramarin bluish violet, 20; pure violet, 5.

The result of these investigations proved that the amount of light in the "warm colors" (as painters call them) is nearly three times as great as it is in the "cold colors," which are those of a blue and blue green shade.

Origin of the Boston Institute of Technology.

Horace E. Scudder has a very interesting article in *Harper's Magazine* for February, on "Education by Hand," from which we extract the following upon the origin of the Boston Institute of Technology:

"The old system of apprentices required a boy to be bound to a master for a term of years, during which time the master was to board and clothe him, to teach him his trade, and to give him such other education as was possible; in return it was expected that the apprentice would spend the last part of his term in labor which would remunerate the master. The ideal master kept the apprentice in his house and treated him as one of the family; the ideal apprentice served his time faithfully, was obedient to his master, and learned his trade thoroughly. But this has all changed. One still finds apprentices here and there, but the system has disappeared. The greater subdivision of labor, consequent upon the introduction of steam-power; the increasing luxury of the master, separating him from the apprentice by greater social distance; 'the existing constitutional aversion of the race to being bound to anybody to do anything'—these and other changes in our more complex society, have caused the system to melt away. In place of it we can only say that children remain longer at the public schools, and then pick up their knowledge of trade almost fortuitously. The ranks are partly filled by foreign workmen, and mechanical employments are avoided if possible. So it is that skilled workmen in any trade seem to be fewer and fewer, while half-educated young men are clamoring for places as clerks or salesmen.

"Franklin did not foresee this condition of things. He never dreamed that in his native city a great public library would be resorted to by crowds of school-children set free from an elaborate system of education, and that the mechanic arts would go begging for workmen capable of building thoroughly the houses in which the school-children were gathered, of making the desks at which they sat, and of printing the books which they read. All attentive observers have been aware of this change, and about ten years ago a committee was appointed by the Massachusetts Charitable Mechanics' Association—the highest representative body of the class—to consider the relations of apprentices to their masters, including the decay of the apprentice system. I only notice this report for a single point. It takes up the suggestion of one of the members that a mechanical college would cure the evil, and disposes of it by two considerations; first, that this could be possible only with the very simplest trades, and then that it would not be practicable to dispose of the articles made by the students who were learning the trades. In the wide diversity of occupations, and in the fact that labor was greatly subdivided, seemed to lie an insuperable objection to any systematic instruction in trades at an educational institution; and then suppose, for example, that watch-making were to be taught at such a school, how expensive the education would be, and how unmarketable the product!

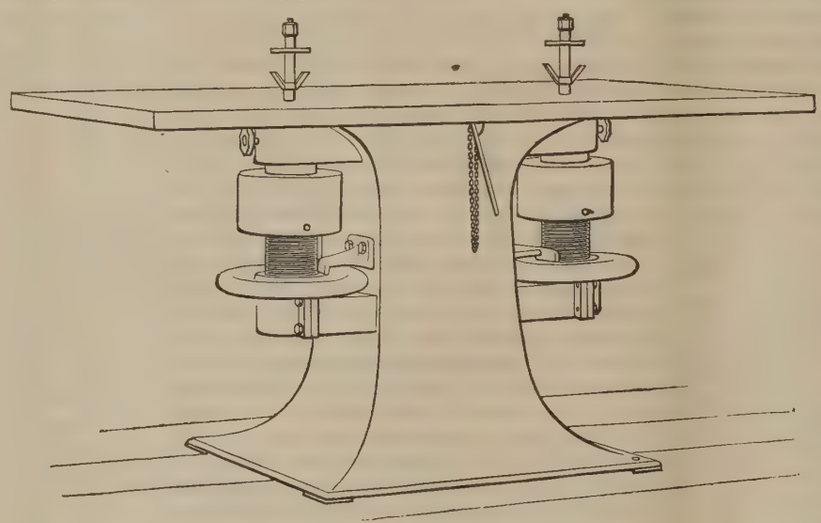
"When this committee reported, there had already been in operation in Boston, for five or six years, a technological school—the Massachusetts Institute of Technology—which, in common with similar schools in other parts of the country, was trying in its own way to bring education distinctly to bear upon the mechanic arts through the application of scientific methods. It had long been shown that the very simplest occupations of industry—agriculture, that is, and the mechanic arts—exacted a knowledge of chemical and physical science before they could be pursued with intelligence and success, and that the old empirical methods must give place to scientific laws. The Institute was established in part for this purpose, and began at once to operate upon a broad basis, the scheme of which was mainly laid down by the eminent Prof. William B. Rogers, who was the first president of the Institute, and, though soon compelled by ill health to resign that office, has always been an active member of the corporation. He has recently resumed the position of president. In this scheme schools were to be established in Mathematics, Design, Physics, Chemistry, and Geology. These schools have since been more minutely subdivided into courses in Civil and Topographical Engineering, Mechanical Engineering, Geology and Mining Engineering, Building and Architecture, Chemistry, Metallurgy, Natural History, Physics, Science and Literature, and Philosophy. Indeed, the practical development of the school has gradually caused it to broaden its scheme and to aim at a comprehensive preparation for active life—a combined collegiate and professional school, with the omission chiefly of the ancient languages."

Blaisdell's Large Variety Molder.

The accompanying engraving illustrates an improved variety molding machine, patented by J. H. Blaisdell, of 107 Liberty street, New York, who is also the inventor of the single-spindle variety molder which is so well known among wood-workers as the Blaisdell Single-Spindle Molder. It is claimed to be the strongest and heaviest machine of its class ever offered to the public, its weight being 2,000 pounds, with table 4 by 7 feet; diameter of journals, 2½ inches, running in self-oiling brass boxes on top, with hardened cast-steel steps floated with oil.

Much difficulty is always experienced in making running parts of machinery at once perfectly firm and at the same time run easy and accurately adjusted. Although this may be accomplished when the work is new, trouble invariably occurs when the parts become somewhat worn. In the present invention the spindles are placed in taper boxes inside the adjustable frame, which is turned to a true and perfect fit, and is raised or lowered by means of a hand-wheel nut with a corresponding thread to that on the spindle-frame, as shown in the engraving. In this particular the device is excellent, as it gives stability to the revolving shaft, and at the same time positive and accurate adjustment of the spindle-frame, (which is not the case with the old style hand-wheel and bevel gear, as it is impossible to do away with the lost motion); besides, the spindles are always kept in line and in the same position, which is sure proof that the machine will do perfect work at all times. The main spindles are 1¼ inches in diameter, with three false spindles—⅜, ⅝ and 1 inch in diameter, fitted by a new and peculiar device never heretofore employed, and on which special claims have been allowed, making the machine capable of adaptation to the lightest or heaviest work, and obviating much difficulty formerly experienced. It is claimed that this molder, from the fact of its frame being cast in one piece, its simplicity, durability, accurate adjustment, and performing every variety of work, is superior to any in the market. Counter-shaft and pulleys are furnished with each machine.

For further particulars address J. H. Blaisdell, 107 Liberty street, New York.



BLAISDELL'S VARIETY MOLDER.

American vs. English Manufactures.

In our June number for 1878 (page 136) we gave an extract from an English paper—the *Ironmonger*—in which the superiority of American locks over those of English make was pointed out. Another English paper—the *Engineer*—now contains a similar doleful tirade in regard to the superiority of most all American hardware over English, and how dealers in England prefer American productions, as being actually better, cheaper, neater, (therefore more salable), and especially much handier for the dealer, on account of the sensible manner in which they are packed in boxes, saving the shopkeeper much time in loosening packages, and allowing him to dispense with 50 per cent of his help.

English manufacturers are exhorted thus: "Are Englishmen to be beaten on their own ground in this way, because men and masters cannot, or will not, depart from old errors of reasonless custom? There seems something like disgrace in the fact that the producers of another land have, even so far as they have, taken the place of home producers." It further says: "The ironmongers tell us, when speaking of the fine, clean, finished American castings, that 'the English cannot do it.' Cannot do it! Surely this is false."

The whole tone of such articles—and most all the papers teem with complaints regarding the present depressed state of English industry—is encouraging for us. It is not only hardware and food that we now export to England, but even that great staple article of her industry—manufactured cotton goods. It appears to be a simple act of retaliation (which we are accomplishing by peaceful, honest labor) for the damage which England inflicted upon us during our late unfortunate civil war, when she drove our commerce from the ocean by openly assisting the extensive privateering operations of the seceded Southern States against all vessels sailing under the United States flag. England then acted on the recognized principle that "business is business," and did not recognize sympathies, hence she profited by the circumstances in which we were involved. At present the United States cannot avoid doing the same, but in a more noble way. Without assisting any enemy of Great Britain, we simply beat her by honest and bloodless industry in the honorable field of the production of various necessities of civilized life.

That England sees and recognizes these facts is evident from the following opinions, selected from various writers and papers:

In the course of a paper recently read in London on "England and her Colonies at the Paris Exhibition," Mr. Frederick Young quoted a large Sheffield manufacturer, who attributed the superiority of several of the samples of hand and machine tools shown from the United States, to the fact of the determination of the American artisan to make good work of everything he takes in hand, in "contradistinction to the growing, most mischievous, and demoralizing sentiment which has prevailed during the last fifteen or twenty years among an increasing class of British workmen, that slovenly and bad work makes more work, and therefore is good for trade."

"I have at this moment," writes Mr. Thomas Fletcher in the *English Mechanic*, "at least three-fourths of my tools of American manufacture, many of which have been bought at a very fancy price. If it were not an absolute necessity, I should be exceedingly foolish to buy American tools at a high price if English tools were to be bought which would do the work equally well. From my own practical experience, the difference between the two is, that an English workman does not, in the first instance, learn what a tool is for, and adapt it to the requirements; an American workman will, as a rule, use his brains and make what you want without spoiling the whole by ridiculous blunders. If I needed a thing, the making of which required judgment on the part of the workman, and I could not give my personal and constant supervision to it, I should, as the simplest way to get the thing right, send my instructions to America."

"It is absurd to argue any longer that we are not suffering from competition," writes Mr. Ashworth in the London *Times*. "Our wares are not so cheap or so good at the price as those of foreign manufacturers. Labor is cheaper abroad, and men work longer hours."

"While Germany is putting all manner of jealous restraints on emigration," says the London correspondent of the *New York Times*, "the English government is rather inclined to encourage people to leave the country than to stay in it; and supposing trade improves in America this year, as everybody thinks it will, the tide of emigration will once more set in from England to the United States. What is more, we shall also experience an emigration of capital, a circumstance which will have special advantages. A healthy manufacturing progress in America will see capitalists as well as laborers emigrating to the United States."

"The price of butcher's meat in the metropolis, exorbitant as it is," says the London *Globe*, "has, no doubt, been kept down by American exports, and we have largely drawn upon the fertile farms of the New World for pork, cheese, and other items of agricultural produce. We are also indebted to the United States for some of the best brands of preserved meats, as likewise for a variety of 'Yankee notions,' including clocks, watches, the famous sewing and washing machines, churns, lemon-squeezers, etc. It seems, however, that America now proposes to compete with us in other branches of industry, such as locks, hardware, and cutlery. Among her recent exports are boots and shoes, perfumery, jewelry, and piece goods. We have no right to complain of these invasions, but it certainly behooves us to endeavor to meet them by producing, if possible, better manufactured articles at equally moderate prices."

Imitation Pearls.

There is no precious stone that is imitated so well as the pearl—in fact, the artificial pearl is superior to the genuine in regard to the durability of its luster and capacity to resist deleterious influences. Thus, for instance, the genuine pearl, being nothing but a carbonate of lime, becomes ruined when put into boiling water, and will entirely dissolve in strong vinegar, while the imitation is not affected. The only point of inferiority is that the imitation pearl, being made of hollow glass beads, is more fragile than the real pearl, and is easily broken.

Various substances are used to coat the inside of the glass, but the best material is derived from the scales of a little fish called the Bleak—*Leuciscus Arburnus*. The scales are dried, reduced to powder, thoroughly washed, and rubbed successively several times. The different portions of water used in these washings are allowed to settle. The water being carefully drawn off by a siphon, a lustrous matter of the consistency of oil remains at the bottom. This substance is called by the French "Essence d'Orient," or essence of pearl. To preserve it and prevent it from becoming putrid it is mixed with ammonia.

The further process of pearl-making consists in blowing this essence of pearl, combined with melted gelatin, into hollow beads made of a peculiar kind of fine glass of a bluish tint. These having received an even and perfect incrustation on their inner surfaces, are then filled with a mucilage of fine gum arabic. For one ounce of the lustrous material no less than a thousand fish are required. Fortunately this kind of fish is very abundant. This process was invented 220 years ago, by Moïse Jaquin, a bead manufacturer in Paris.

PAPER BRICKS.—A manufactory of paper bricks has been started in Wisconsin. The bricks are said to be exceedingly durable and moisture-proof. They are also larger than the clay article. What next?

Latest Market Report of Building Materials.

NEW YORK PRICES.

ARTICLES MARKED WITH A STAR (*) ARE QUOTED IN GOLD.

—o—

LUMBER.

Pine, very choice and extra dry, per M	$55 00 @ 60 00
Pine, good	45 00 @ 50 00
Pine, shipping box	18 00 @ 22 00
Pine, common box	16 00 @ 17 00
Pine, common box, ⅝	13 00 @ 15 00
Pine, tally plank, 1¼, 10 inch, dressed, each	40 @ 43
Pine, tally plank, 1¼, 2d quality	35 @ 38
Pine, tally plank, 1¼, culls	25 @ 28
Pine, tally boards, dressed, good	28 @ 30
Pine, tally boards, dressed, common	22 @ 25
Pine, tally boards, culls, dressed	21 @ 23
Pine, strip boards, merchantable	16 @ 18
Pine, strip boards, clear	22 @ 25
Pine, strip plank, dressed, clear	33 @ 35
Spruce boards, dressed	18 @ 20
Spruce plank, 1¼-inch, dressed	22 @ 25
Spruce plank, 2-inch	28 @ 34
Spruce wall strips	13 @ — 15
Spruce timber, per M	16 00 @ 19 00
Hemlock boards, each	14 @ — 16
Hemlock joist, 2½x4	15 @ — 16
Hemlock joist, 3x4	16 @ — 18
Hemlock joist, 4x6	40 @ — 44
Ash, good, per M	38 00 @ 45 00
Oak	38 00 @ 45 00
Maple culls	20 00 @ 25 00
Maple good	42 00 @ 45 00
Chestnut	42 00 @ 48 00
Cypress, 1, 1½, 2, and 2½-inch	35 00 @ 40 00
Black walnut, good to choice	85 00 @100 00
Black walnut, ⅝-inch	75 00 @ 85 00
Black walnut, selected and seasoned	110 00 @150 00
Black walnut counters, per ft	12½ @ 20
Cherry, wide, per M	85 00 @100 00
Cherry, ordinary	60 00 @ 80 00
White wood, chair plank	60 00 @ 70 00
White wood, inch	40 00 @ 50 00
White wood, ⅝-inch	30 00 @ 35 00
White wood, ⅝ panels	35 00 @ 40 00
Shingles, extra shaved pine, 18-inch	9 50 @ 10 00
Shingles, extra shaved pine, 16-inch	8 50 @ 9 50
Shingles, extra sawed pine, 18-inch	7 00 @ 8 00
Shingles, clear sawed pine, 18-inch	6 50 @ 7 50
Shingles, cypress, 24x7	20 00 @ 22 00
Shingles, cypress, 20x6	12 00 @ 15 00
Lath, Cargo rate	— — @ 1 50
Yellow dressed pine flooring	25 00 @ 35 00
Yellow pine girders	30 00 @ 40 00
Locust posts, 8 feet, per inch	18 @ 20
Locust posts, 10 feet	24 @ 25
Locust posts, 12 feet	29 @ 34
Chestnut posts, per ft	3 @ 3½
Basswood per M	25 00 @ 30 00

BRICKS.

Nominally.	Cargo.	Afloat.
Pale, per M.	2 50 @ 3 00	
Jersey	4 50 @ — —	
Long Island	— — @ — —	
Up-River	4 00 @ 4 25	
Haverstraw Bay	4 25 @ 4 50	
" " choice	4 62 @ 4 75	
Favorite Brands	5 00 @ 6 00	

FRONTS.

Croton—Brown, per M.	— — @ 7 00
" Dark	— — @ 8 00
" Red	— — @ 9 00
Philadelphia	26 00 @ 28 00
Trenton	24 00 @ 29 00
Baltimore	34 00 @ 38 00

Yard prices 50 cents per M higher, or with delivery added $2 per M for hard and $3 per M for front brick. For delivery add $5 on Philadelphia and Trenton, and $6 on Baltimore brick.

IRON—PER TON.

Pig, Scotch—Coltness	21 50 @ 22 50
Gartscherrie	— — @ — —
Glengarnock	20 50 @ 21 50
Eglinton	19 50 @ 20 50
American, No. 1	16 50 @ 18 00
American, No. 2	15 50 @ 17 00
American, forge	14 50 @ 16 00

Store prices. Cash.

Bar, Swedes, ordinary sizes	— 5 @ — 6
Ba., Swedes, nail-rod	— — @ — 6½

LEAD—PER 100 POUNDS.

*German	— — @ — —
*English, common	— — @ — —
*Spanish	— — @ — —
*Foreign, refined	— — @ — —
*Bar	5 00 @ — —
*Sheet and Pipe	5 00 @ 6 00
*Domestic	3 37 @ — —

NAILS—PER KEG.

10d to 60d, common, fence and sheathing	2 30 @ — —
8d and 9d, common	2 85 @ — —
6d and 7d, common	3 10 @ — —
4d and 5d, common	3 35 @ — —
3d and 4d, light	4 10 @ — —
3d, fine	4 85 @ — —
2d, fine	4 85 @ — —
Cut spikes, all sizes	2 85 @ — —
Clinch nails, 1½ to 1¾ inch	5 00 @ 5 25
do. 2 to 2¼ inch	4 75 @ — —
do. 2½ to 2¾ inch	4 50 @ — —
do. 3 inch and longer	4 25 @ — —

TIN PLATES.—Duty, 1 1-10 cents per pound.

*I. C. charcoal, 10x14, per box	6 00 @ 6 25
*I. C. coke, 10x14	5 25 @ 5 75
*I. X. charcoal, 10x14	8 00 @ 8 25
*I. C. charcoal, 14x20	6 00 @ 6 25
*I. X. charcoal, 14x20	8 00 @ 8 25
*I. C. coke, 14x20	5 00 @ 5 75
*I. C. coke, terne, 14x20	5 00 @ 5 12½
*I. C. charcoal, terne, 14x20	5 25 @ 5 50

ZINC.—Duty, sheet, per lb., 2½ cents.

Sheet, (cask) per lb	— 6 @ — 6¼
Sheet, (open)	— 6½ @ — 6⅝

STONE.—Cargo Rates.

Amherst Freestone, in rough, per cubic foot	— — @ — 85
Berlin Freestone, in rough	— — @ — 95
Berea Freestone, in rough	— — @ — 75
Brown-Stone, Portland, Conn	1 25 @ 1 50
Brown Stone, Belleville, N. J	1 00 @ 1 50
Granite, rough	— 60 @ 1 25
Canaan Marble	1 25 @ 1 50
Dorchester, N.B., Stone, rough, per foot	— — @ 1 03

SOLDERS.

No. 1	— 10½ @ — 11
No. 2	— 8½ @ — 9½

PLASTER PARIS.

Duty.—20 per cent ad. val. on calcined; lump free.

Nova Scotia, white, per ton	2 80 @ — —
Nova Scotia, blue	2 75 @ 2 80
Calcined, Eastern and city, per bbl	1 00 @ 1 10
Calcined, city casting	1 15 @ 1 25
Calcined, city superfine	1 25 @ 1 50

LIME—PER BARREL.

State, common	— 80 @ — —
" finishing	— 90 @ — —
Rockland, common	— 75 @ — —
" finishing	— 90 @ — —
Ground	— 80 @ — —

Add 25 cents to above figures for yard rates.

CEMENT—PER BARREL.

Portland (imported)	2 75 @ 3 25
Portland (American)	2 50 @ 2 90
Roman	2 80 @ 3 25
Keene's, coarse	6 50 @ 7 00
" fine	10 00 @ 10 50
Martin's, coarse	6 00 @ 6 50
" fine	10 00 @ 10 50
Rosendale	— 80 @ — 90

DEADENING AND ROOFING MATERIAL.

Mineral Wool for Roofs and Deadening, per lb.	— 1¼ @ — 1½

HAIR.

Cattle, per bushel of 7 lbs	— — @ — 10
Goat, " "	— — @ — 12½
Vegetable Fiber (substitute for hair) per lb.	— — @ — 20

SLATE.

Purple roofing slate, per square	$6 00 @ 7 00
Green slate	6 00 @ 7 00
Red slate	10 00 @ 11 00
Black slate, Pennsylvania	5 00 @ 5 25
Slate tiles, 1¼-inch, rubbed, per square foot	20 @ 25

PAINTS.

*Carmine, American, per lb. gold	5 00 @ 5 50
Chalk, per lb.	— 00¼ @ — 00⅜
China Clay, per ton gold	20 00 @ 22 00
Chrome yellow, dry, per pound	— 12½ @ — 28
Lead, red American, per pound	— 7 @ — 8
Lead, white American, pure, in oil	— 7½ @ — 8
Lead, white American, pure, dry	— 6¾ @ — 7¼
Lead, white English, pure, in oil gold	— 10 @ — 10½
Litharge	— 7 @ — 8
*Ochre, Fr., dry, per 100 lbs	1 50 @ — —
Ochre, ground, in oil, per lb	— 6 @ — 15
Ochre, Vermont, per 100 lbs	— 75 @ 1 00
*Orange Mineral, English gold	— 9½ @ — 10
Paris White, American	— 1¾ @ — 1½
Paris White, English, prime	— 1¾ @ — 2
Paris Green	— 15 @ — 28
Plumbago paint, patent, per lb	— — @ — 25
Putty, per lb	— 1¾ @ — 2½
Spanish Brown, dry, per lb	— 1⅛ @ — 1¼
Spanish Brown, ground in oil, per lb	— 8 @ — 9
Venetian red, per cwt	1 75 @ 2 00
*Vermilion, Chinese, per lb	— 80 @ — 90
*Vermilion, Trieste	— 70 @ — 80
*Vermilion, quicksilver, bags gold	— 55 @ — 57½
Vermilion, American, common	— 15 @ — 18
Whiting, per 100 lbs	— 40 @ — 75
Zinc, white American, dry, No. 1	— 6½ @ — 7½
Zinc, white American, No. 1, in oil	— 8 @ — 10
*Zinc, white French, dry, (Red Seal) gold	— 8 @ — 8¼
Zinc, white French, in oil gold	— 10 @ — 10½

VARNISHES—PER GALLON.

American Wearing Body	3 50 @ 4 00
Coach Body	2 35 @ 3 50
do do	1 80 @ 2 00
Furniture	1 25 @ 2 50
Black Asphaltum	1 00 @ 1 50
Brown Japan	1 00 @ 1 20
Liquid Paint Dryer	1 35 @ 1 75
Harness, (black)	3 00 @ 4 50
Shellac, Spirits	3 00 @ 3 50

FOREIGN WOODS.

MAHOGANY.

St. Domingo, crotches, ordinary to good, per ft	— 15 @ — 20
St. Domingo, crotches, fine	— 20 @ — 30
St. Domingo, logs, small	— 5 @ — 8
St. Domingo, logs, large	— 8½ @ — 14
Frontera, Mexican, large	— 9 @ — 12½
Frontera, Mexican, small	— 6 @ — 8
Other Mexican	— 6 @ — 12½
Honduras	— 6 @ — 12½

ROSEWOOD.

Rio Janeiro, ordinary to good, per lb	— 2 @ — 3½
Rio Janeiro, good to fine	— 4 @ — 8
Bahia, ordinary to good	— 1¾ @ — 3
Bahia, good to fine	— 3 @ — 7
Honduras, per ton	10 00 @ 20 00
Satin Wood, per foot	— 15 @ — 25
Tulipwood, per lb	— 6 @ — 7
Lignumvitæ, small, per ton	10 00 @ 20 00
Lignumvitæ, large	25 00 @ 50 00

CEDAR.

Cuba, per superficial foot	— 8 @ — 12½
Mexican, small	— 8 @ — 9½
Mexican, large	— 10½ @ — 12½
Florida	— 40 @ — 75

DOORS, WINDOWS, AND BLINDS.

DOORS, RAISED PANELS, TWO SIDES.

2.0 x 6.0	1¼ inch.	$ 75	—
2.6 x 6.6	1¼	1 05	—
2.6 x 6.8	1¾	1 10	—
2.8 x 6.8	1¾	1 15	—

DOORS, MOLDED.

Size.	1¼ inches.	1½ inches.	1¾ inches.
2.0 x 6.0	$1 37	—	—
2.6 x 6.6	1 69	2 14	—
2.6 x 6.8	1 73	2 16	—
2.6 x 6.10	1 76	2 23	—
2.6 x 7.0	1 80	2 32	—
2.8 x 6.8	1 80	2 32	2 85
2.8 x 7.0	1 88	2 41	2 99
2.10 x 6.10	1 98	2 51	3 46
3.0 x 7.0	2 07	2 71	3 33

WINDOW FRAMES.

Up to 3.4 x 7.2, put together	2 30 @ — —

INSIDE BLINDS.

Per lineal foot, 4 folds, pine	50 @ — —
Per lineal foot, 4 folds, ash or chestnut	— 80 @ — —
Per lineal foot, 4 folds, cherry or butternut	— 95 @ — —
Per lineal foot, 4 folds, black walnut	1 15 @ — —

OUTSIDE BLINDS.

Up to 2.10 wide, per lineal foot	— @ —
Up to 3.1 wide	— @ —
Up to 3.4 wide	— @ —
Do. painted and trimmed	40 @ —

DRAIN AND SEWER PIPE.

(Delivered on board at New York.)

PIPE, per running foot.

2 inches diameter,	$0 13		10 inches diameter,		$0 70
3 "	0 16		12 "		0 80
4 "	0 20		15 "		1 25
5 "	0 25		18 "		1 60
6 "	0 30		20 "		2 00
7 "	0 35		22 "		2 50
8 "	0 45		24 "		3 00
9 "	0 55				

GENERAL REVIEW OF THE MARKETS.—Demand the past month in all the markets under review has shown about the same form as for several months past, and we find few features of interest to record. Dealers look forward with a considerable degree of confidence respecting business the coming spring, and the tone is all the more healthy from being free of positively buoyant expectations, and merely looking for a good distribution of stock with a fair hardening on values. The preparations making at present indicate that building operations will be active, one estate alone, that of the Rhinelanders, contemplating the erection of four hundred buildings in various parts of the city.

THE MARKETS IN DETAIL.—In the lumber market the past month demand has not amounted to much, except in a jobbing way. Supplies have been fair as against the requirements of the markets, and prices have ruled steady.

In the brick market trade has been quiet; the river points of supply have of course been closed to navigation, and though a few cargoes were received through other sources, they found a slow market, no one seeming to want them. A number of contractors have been finishing up jobs in hand, and have sought no new material for the time being, while the weather during a great part of the month has been unfavorable for pushing forward even work under way. Pale bricks have been scarce and slow, and fronts quiet and steady.

In the lime market business has had about the same slow tone and a basis of former rates, prices being unchanged.

The lath market has been firm, and the selling interest has had the greater advantage of the position. The distribution has been slow, but stocks light, and the latter has tended to stiffen prices, the latest rate being $1.50.

In the hardware market trade has had a very uncertain tone, demand being pretty well suspended. Dealers generally, however, look hopefully to the future and a good spring trade is predicted.

In the metal markets, Scotch pig iron has found only a moderate and uncertain demand with the tone of trade flat and values to a considerable extent nominal. American pig has not found much of an outlet, the current demand being light and consumptive wants met by stock already in hand. Prices are about as before. Manufactured iron has been selling somewhat freely in small lots from store, the call being mainly for standard grades. Domestic pig lead has been selling moderately. Pig tin has shown great irregularity, and nearly all dealers have differed more or less in quotations, with current figures as named to some extent nominal. Tin plates have met with a fair demand.

In the paint market former values have been asked, and a reasonable show of business has been made.

A NEW METAL.—M. Delafontaine announces the discovery of Philippium, a new metal. He has obtained from gadolinite, an oxid of a really new metal, to which he gives the name of "Philippium," (Pp.), in honor of M. Philippe Plantamour, of Geneva, the friend and student of Berzelius. Supposing Philippium to be a protoxid, its approximate equivalent is between 90 and 95. M. Delafontaine describes in the *Comptes Rendus* some properties of its formiate, sulphate, nitrate, etc. Philippium gives well marked characteristic bands in the spectroscope.

The Study of Foreign Languages.

MAX MÜLLER'S ADVICE ABOUT IT.

About twelve years ago two young ladies in England, who were a little eccentric and wild, wrote a letter to the great Oriental linguist, Max Müller, asking his counsel upon the choice of a language which no one else in England knew, and which they might learn with pleasure and profit. As they only knew him by his reputation as an enthusiast for Oriental literature, they expected either a short reply, recommending what they supposed to be his hobby, or the advice that such studies were too high and utterly useless for women. They were surprised, however, by a reply which has a value in itself, and may be useful to other would-be students of languages; therefore we copy the principal points. Prof. Müller wrote:

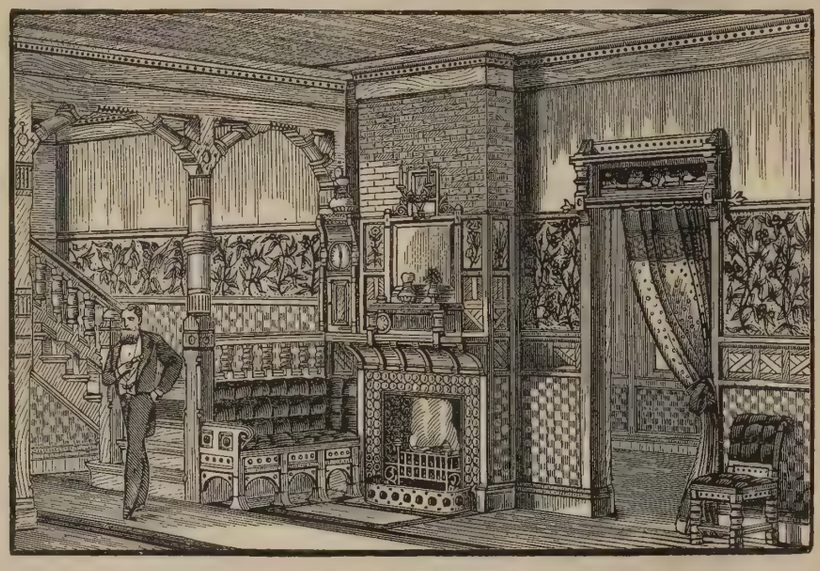
"It is by no means easy to reply to your inquiry. To take up any work in good earnest is a most excellent thing, and I should be the last person to find fault with anybody for fixing on learning a language, even for the mere sake of learning something. Yet it is right that our work should have some useful object beyond the mere pleasure of working. Thus in selecting a language, we might look at three ulterior objects—literature, travel, or science of language. Now, as I have no reason to suppose that you want to learn a language that might be useful to you in travelling, or that might furnish promising material for scientific analysis, I will take it for granted that literature would form an object of interest to you in the choice of a language. As it is to be a language which few people in England are likely to know, I hould say take Portuguese, if you like romance; or take Swedish, if you like Teutonic languages. The books for learning these languages are easily procured, and there is a literature both in Swedish and Portuguese very little known in this country, and well deserving the interest of two young ladies. But I am afraid you will consider both Portuguese and Swedish as far too common-place. Well, in that case, take Siamese. You will have some difficulty in getting grammars and dictionaries, yet, if you are in earnest and apply to —— ——, you will with some little trouble and expense get what you want. There is not a single man in Europe, I believe, who knows Siamese. The French, however, are opening the country, and some of their agents and missionaries have begun to study the language. The alphabet is troublesome, but the grammar itself is easy. There is a vast literature, as yet almost unknown; the King of Siam is a man of literary tastes, who reads and writes English, and would no doubt be delighted to receive, say two or three years hence—for it will at least take that time—a letter written in his own language by two English ladies. With this little glimpse of romance looming in the distance, I must close my letter, and beg to remain, with best wishes for perseverance and success," etc.

Artificial Marble.

A process has been invented by Miss Hosmer, the sculptress, for making artifical marble which differs from previous processes in the fact that limestone in the solid state is employed as the base instead of a mixture of plaster and cement. The limestone is worked by any suitable means to the desired form, and is then placed in a boiler furnished with a safety-valve and manometer, so that the pressure therein may be noted and controlled as may be required. The boiler is filled with pure water at the ordinary temperature, care being taken that there is no mineral deposit introduced with the water, and that the water completely covers the objects placed within the boiler. The boiler is then hermetically sealed, and fire applied, and the water allowed to boil until the manometer indicates 75 pounds of atmospheric pressure if the objects are small, and 90 or 100 lbs. of pressure if the objects are large. When the heat reaches the above-mentioned point the water is allowed to cool until the pressure indicated by the manometer returns to zero. The water is then taken out of the boiler either by means of a pump or a syphon, and the objects are removed from the boiler preparatory to being placed in the alum or colored bath, various recipes being given for different colors.

Remodelled Hallway.

We offer the accompanying illustration as an example of remodelling. In the original house the stairway was narrow and enclosed. This has been removed, and a new staircase in hard wood introduced, with fireplace and settle at the foot of the same, and at the end of the settle the old hall clock. The upper portion of this fire-place has the brick-work exposed, the lower portion being encased for mirror, etc., and above the mirror a small sconce mirror. As will be noticed, the doorways into the principal rooms from this hall are without doors; a curtain of heavy material, hung to a rod with rings, forms a means of shutting off the view from the hall when desirable. The end of the main hallway is marked and divided by a newel column, bracketed each way.



VIEW OF HALLWAY.

We are indebted to Bicknell & Comstock, of this city, for our illustration and description, from one of their latest publications, entitled "Woollett's Old Homes Made New," containing twenty-two plates of exteriors and interiors.

Early Days of Gas-Lighting.

The use of gas for the purpose of producing light was first introduced by a Mr. Murdoch, of Redruth, in Cornwall, England. As early as 1792 this gentleman lighted his house with gas made in an apparatus of his own construction. It was not, however, until 1803 that any attempt was made to introduce it into London, when a Mr. Winsor lectured on the subject and exhibited a specimen of gas-light at the Lyceum. A company called the National Light and Heat Company was soon after projected by Mr. Winsor and his supporters; and in January, 1809, with the view of convincing Parliament and the public of the practical nature of their scheme, the company lighted Pall Mall from St. James street to Cockspur street.

According to Mr. Winsor's calculations, founded on official experiments, the profits were to be so large as to ensure to the shareholders an annual interest of $2,850 for every $25 invested in the undertaking. He estimated that the value of the residuary products would reach nearly $1,150,000,000 per annum. The government was also promised that the scheme would produce in a short time no less than $50,000,000 in the way of taxes. These extravagant estimates naturally had the effect of exciting ridicule and opposition. In 1809 application was made to Parliament for an act to incorporate a company to be called the London and Westminster Chartered Gas-Light Company, but owing to the prejudice that was entertained, chiefly from the idea that gas-lighting was attended with danger, the bill was thrown out. Mr. Wilberforce, by whom it was strongly opposed in the House of Commons, said he considered the scheme "one of the greatest bubbles that had ever been imposed on public credulity."

The application, however, was renewed in the following year, and this time it was successful. But still the lighting of a town with gas was for some time looked upon as a visionary scheme both by the public and by men of science. Sir Humphrey Davy is reported to have asked, as a sneer, whether it was intended to use the dome of St. Paul's as a gasometer. With a view of inducing persons to adopt their invention, the gas company, in the first instance, supplied shops and houses with both gas and fittings free of charge. After the year 1814 gas came more generally into use for lighting both streets and houses, but it was terribly dear. In 1815 the price was $3.75 per 1,000 cubic feet, and the amount consumed was guessed at, meters being then unknown. The extravagant promises as to the profits to be derived were not destined to be realized; and indeed for several years no dividends whatever were paid. It is a curious fact that it was for some time believed that gas would have the effect of heating the pipes through which it passed; and when the passages of the House of Commons were first lighted with gas, the architect caused the pipes to be fixed four or five inches from the walls, for fear of fire. On the other hand, a patent was taken out for making gas-pipes of wood and paper. On the first introduction of the new light, the demand for pipes was so great that for some little time there was considerable difficulty in obtaining a sufficient supply, and musket-barrels screwed together were used for the purpose. Westminster Bridge was lighted with gas in 1813. In the following year the parish of St. Margaret, Westminster, set the example to the other parishes by removing the oil-lamps and substituting gas in their place; and by 1820 it was pretty generally used throughout the metropolis. As an illustration of the strong prejudice there was against the new light, and of the length of time this feeling existed, it may be mentioned that the Haymarket Theater was not lighted by gas until April, 1853, the proprietor binding the lessee to adhere to the old-fashioned mode of lighting with oil.

INTERESTING REMEDY FOR COLOR BLINDNESS.—The kind of color blindness by which some persons cannot distinguish green from red, and which is called "Daltonism," can be corrected by spectacles of fuchsin red. M. Delbocaf, a French physician, colors a thin layer of gelatin by means of fuchsin red, places it between two pieces of glass, and inserts it in a spectacle frame. It is claimed that persons affected with this kind of color blindness are, by means of such spectacles, able to recognize colors, which, without them, they cannot distinguish.

Home Department.

Some Hints in Regard to Diet.

A correspondent of the New York *Sun*, in a letter defending an exclusively vegetable diet, in support of his views, says that in Dr. Hall's *Journal of Health*, a few years ago, the following statement of the amount of nutriment in various articles of food was given:

"Raw apples, 10 per cent; boiled beans, 87; roasted beef, 26; baked bread, 80; butter, 96; boiled cabbage, 7; raw cucumbers, 2; boiled fish, 20; fresh milk, 7; roasted mutton, 30; roasted pork, 24; roasted poultry, 27; boiled potatoes, 13; boiled rice, 88; sugar, 96; boiled turnips, 4; roasted veal, 25; and boiled venison, 22."

From this loose statement of Dr. Hall he makes the the following deductions:

"The cheapest articles of food, except butter, are the most nourishing. A pint of white beans, costing a few cents, contain the same amount of nutriment as 3½ pounds of prime roasting beef, which is twelve times as expensive. Furthermore, a pound of Indian meal will go as far as a pound of fine flour."

We called it a loose statement, and so are all the statements made in various books in regard to the comparative nourishing qualities of various kinds of food, as they are all based on some false premise; some, for instance, on the percentage of nitrogen in the food, others on the amount of water in it, etc. The result is an erroneous comparison, and the deductions drawn must be false. Thus in the above table, sugar is 96 per cent, and turnips 4 per cent, making 24 pounds of turnips equivalent to 1 pound of sugar; rice 88 per cent and roasted beef 26, making 1 pound of roasted beef not much more nourishing than 4 ounces of boiled rice. The whole assertion is simply absurd and the table worthless, as every one will maintain who properly attends to the duty of selecting his food judiciously in regard to the wants he feels.

We deliberately call it a duty to be careful in selecting our food; we even go further, and call it a crime not to feed well, or to be negligent in our selection, eating or drinking things we dislike, or, what is worse than all, eating when we have no appetite, simply because it is time for meals.

The correspondent above referred to closes his article thus: "I remember reading in the *Tribune*, while Horace Greeley was editor, that one pound of cracked Southern corn, boiled nine hours, adding water and stirring occasionally, to keep it from burning, would form a glutinous, nutritive mass of nine pounds when cold, and that a person could live and keep healthy on ten cents' worth of corn a week."

To this we remark that very few constitutions can stand a corn diet. In most cases corn has a tendency to sour on the stomach, and by its continued use chronic dyspepsia and premature death results.

Man, and especially civilized man, needs a variety of food. The man who does a great deal of brain work requires different food than the man who only works with his muscles, as the one consumes more nervous material, and the other muscular; and as different as the chemical composition of the brain and nerves is from that of the muscles, equally different must be the character of the food needed to supply the waste.

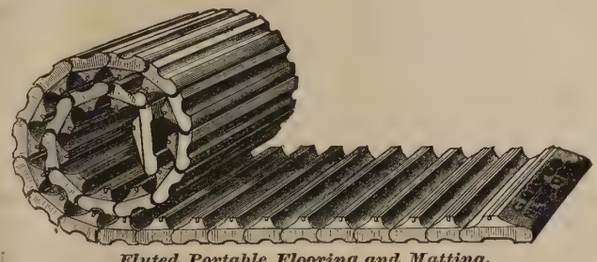
Compressed Coffee.

Some time ago we mentioned that the tea-dust obtained in abundance in tea-packing establishments was being compressed in England into cakes, and that in this way an otherwise unsalable article was being introduced into the trade; however, not claimed to be made from the dust, but pretended to be made from the leaves. We find it now reported that coffee is also prepared in this way. However, no waste or unsalable material accumulates; the roasted beans have to be ground, and the ground coffee is compressed by means of molds into solid cakes by a pressure of some 1,000 pounds to the square inch, forming a smooth, solid mass resembling chocolate. The cakes thus formed are preserved in tinfoil, by which the flavor due to a peculiar ethereal oil is retained. We hope that the ease with which such cakes can be adulterated with burnt sugar, will be no inducement to do it.

Fluted Portable Flooring and Matting.

A new article of manufacture, intended for flooring and matting, has lately been introduced by Mr. George Hayes, of 71 Eighth avenue, New York. A specimen of the same is represented in the adjoined engraving, partly rolled up; it is chiefly intended for crowded and much trodden floors, stairs, and landings.

It is made of strips of hard wood, attached by strong thread-work upon wire cord, in such a way as to be easily rolled up. At doorways and in vestibules the sharp edges of the ridged surfaces effectually remove dirt from the feet and drop it into the grooves between, where it remains undisturbed until removed and swept, or dropped out of the mat in cleaning. This it does in common with some other kinds of matting, but more neatly. Used inside of crowded halls, passage-ways of stores filled with costly goods, etc., it performs an important office in regard to dust. This it collects and retains out of reach of the feet, which otherwise would continually sweep it about the floor and fill the air with it.



Fluted Portable Flooring and Matting.

For the preservation of costly floors of wood or marble from wearing into holes where much trodden, as in hotels, apartment houses, etc., it is at once a durable and handsome article, as it can be varnished, or otherwise kept in as perfect order as the floor itself. It is also a preventive against slipping.

For greater dryness and cleanliness, a requisite not generally secured in matting, it is grooved underneath as well as on its upper surface, thus affording a free passage of air, which is a great advantage in case there is a damp floor or carpet. Where there is most excessive wear, the treading surface is inlaid with iron, steel, or other material of a more durable character, making the mat not only more lasting, but more ornamental as well.

It will be evident that in a bank, or other place where the floor is much trodden upon by people going in and out, carrying water and mud with them on their feet, and dripping umbrellas in their hands, ordinary floor mats become soaked, and hollows in the floor filled with water, making it very unpleasant. The application of this flooring obviates this, alike in preventing the wear or in covering the hollows of a worn floor.

Female Wages.

Women complain, and very justly, of the discrimination made against them in the matter of wages. They receive generally, as is well known, much less than men, even when doing the same work that men do, the fact of their sex being thus, most ungallantly and unrighteously, counted against them. Perhaps, the highest price paid in the country proper to any number of women is in Boston, where as school-teachers, they get $15.39 a week the year round, including 10 weeks of vacation. Statistics of the relative wages of the sexes have been made up in a number of States for 1875. In Massachusetts, the average earnings per month for men was $88.37; for women, $35.35. In Maine, men, $37; women, $18. In Pennsylvania, men, $41.07; women, $34.09. In Ohio, men, $60; women, $44. In Michigan, men, $51.29; women, $28.19. In some States, however, in Iowa, for example, the custom of allowing the same salary to men and women for the same kind of work is growing general. In St. Louis no distinction of sex is made in respect to teachers' pay. When women do men's work they receive equal wages. The California Legislature determined years since that female teachers in the public schools should have the same pay as male teachers for like service. Some of the Southern States, and Arizona, Idaho, and Nevada, pay men and women equally, so that justice is likely to be done ere long to all women obliged to earn their own livelihood. Teachers of both sexes in the schools, all primary, of Arizona earn from $100 to $125 a month, but one should be paid handsomely for merely living in Arizona.

Bad Temper and Insanity.

Says the *Popular Science Monthly*: "Passionate people—the hasty kind—who flare up in a blaze, like fire to tow or a coal to powder, without taking time to inquire whether there is any ground for such a pyrotechnic display, and then get more furious when they find out there was no cause for their fiery feats, may learn a useful as well as a serious lesson from an item in Dr. Blanchard's report of the King's County Lunatic Asylum, that 'three men and three women became insane by uncontrollable temper.'

"We all feel a sympathy for one who has become demented from loss of kindred, from disappointment, and from a hard lot in life; but we can have no such feeling for quarrelsome, ill-natured, fretful, fault-finding, complaining, grumbling creatures, the greater part of whose every-day life tends to make those whose calamity it is to be bound to them, as miserable as themselves. Bad temper is a crime, and, like other crimes, is ordained in the course of nature, to meet, sooner or later, its merited reward. Other vile passions may have some points of extenuation, the pleasure, for example, which may attend their indulgence, but ill-nature—that is, a fretful, fault-finding spirit, in its origin, action and end, has no extenuating quality; and, in the application of the old principle, 'with what measure ye mete, it shall be measured to you again,' will find a most pitiable end. Therefore, with all the power that has been given you, strive, and strive for life, to mortify this deed of the flesh. Watch hourly, watch every moment against the indulgence of a hasty temper, as being offensive to yourself and contemptible in the eyes of your fellow-man—contemptible, because for the person who possesses it, and knows it, yet indulges in it, and makes no effective efforts to restrain it, no human being can have any abiding attachment or respect, founded as it is in low morals, or low intellect, or both."

Care of the Health.—Health, by some eminent writer, has been described as "the poor man's blessing—the rich man's bliss." With it the most brilliant endowment of mind, the most careful and thorough culture, are of little account in a life-career. In this view early instruction in all that appertains to our physical well being is of prime importance. The earnestness with which some men have stood forth in the van of this cause will be better understood and appreciated in the future than it is to-day. A distinguished physician pertinently said, in a recent discussion:

"Modern science, in connection with the most advanced views of education, is teaching us more and more every year, the importance of good health—of a sound constitution, in order to secure the highest success in life; and this depends very much upon the proper care and training of the body in youth. It is becoming evident that physical culture is to occupy a far more prominent position in all our systems of education than heretofore, and must ere long be introduced in some form, into the regular exercises of all

our schools, seminaries, and higher institutions of learning. We venture this prediction, that in no department of education will there be greater improvement for the next fifty years, than in a more perfect development of the human system and harmony of function, between the laws that govern both the mind and the body."

Design for Dwelling House.

On the opposite page are represented the elevations and plans for dwelling house recently erected for Joseph L. Cooper at Flatbush, L. I., from designs by Bicknell & Comstock, architectural designers and publishers of 27 Warren street, New York.

It will be seen by the front and side elevations shown that the design possesses admirable features in every part while the floor plans present a most convenient arrangement.

On the first floor there is a parlor 15 feet 6 inches by 14 feet 6 inches; sitting room, 17 feet 6 inches by 9 feet; dining room, 17 feet 6 inches by 11 feet 6 inches; kitchen, 13 feet 6 inches by 12 feet; a hallway extends from the front-door to dining room and has a door leading into the latter, and also into the parlor. In the dining and sitting rooms there are good sized closets and a pantry off kitchen. Entrance to the latter room is obtained from the rear of the house and also from the stoop on side. On the second floor there are three good-sized bed-rooms measuring 14 feet 6 inches by 14 feet; 17 feet 6 inches by 11 feet; and 17 feet 6 inches by 9 feet respectively. On this floor there is a water-closet and bath-room, and ample closets.

Extending along the front of the house is a veranda while in the dining and sitting rooms there are commodious bay windows, adding not a little to the general attractiveness of the design.

This house can be executed in the vicinity of New York as directed in the specification given below (which is the one from which Mr. Cooper's house was erected) for $3,000. In some localities, depending upon local circumstances, the design could be carried out for considerably less, ranging from $2,000 to $3,000.

The following is a complete specification of labor and material required in the erection of this house:

Hights.—Cellar to be 7 feet high to first floor beams; first story, 10 feet high in the clear; second story, 9 feet high in the clear; first story level, 2 feet above finished grade. *Excavating.*—Do all excavating required for the work in all its parts, fill in again, and make surface good. Owner will do all grading. *Bottoms, Etc.*—Bottoms to be firm, and footings of broad stones in best manner; on these build the walls in best manner, 20 inches thick, of good building stone in best mortar, laid neatly, and continued above grade with good hard brick 2 feet. In this wall build cellar outside door and four cellar windows, the door 3½ feet wide and as high as possible, and the windows 15 inches by 3 feet; blue stone sills to both. Also build cellar steps and checks or walls around the same; blue stone steps; walls same as cellar walls. In cellar build a cross wall of 8-inch brick under main partition; have one arch in it. Also build two 12-inch brick piers in cellar. No cellar under the wing; this part may have a trench wall 3½ feet below grade, and 2 feet above ground, of good hard brick, well pointed up. Build outside piers under veranda, of good hard brick, 12 inches square. *Chimneys.*—Start the chimneys on good foundations, carry up plumb, as shown in drawings, and top out neatly; parge the flues, and make fire-safe when running near any wood-work, by plastering on outside. Build chimney in dining-room, and jambs for range in kitchen, as shown on plans. The fire-place to have an 18-inch slate hearth. Furnish all labor and material for setting any marble mantels that the owner may furnish. *Filling-in.*—Fill in between studs, from sill to plate, with soft bricks in mortar, making all tight. *Plaster.*—In first and second stories throughout, plaster with two good coats on good lath, in best manner, and finish with coat of best hard finish. All the first floor, except kitchen, to have a 6-inch cornice of stucco, and the three chambers in second story to have a small cornice. Ram down cellar bottom and leave all smooth; to be cemented in thick with the best Rosendale cement and good sand. *Cess-Pool.*—Build when directed on lot two dry, rubble-stone cess-pools, in best manner; build in all drain-pipes from house, and overflow from cistern, these pipes to be 6 inches in diameter; cess-pool 8 feet in diameter and 8 feet deep; have man-hole, cover, fastenings, etc. *Cistern.*—Also build a rain-water cistern in best manner, of brick, dome over, and make complete, with man-hole, etc.; cistern to be 12 feet deep, 8 feet in diameter, and 8-inch bottom; all plastered inside with cement and made perfectly tight; furnish and build in 6-inch drain-pipes from foot of house-leaders; have good slant.

Carpentry-Work.—All carpentry-work may be plain, but it must be neat and strong in every part. *Frame.*—The frame, unless otherwise specified, to be of sound spruce timber, well framed and put together, and thoroughly braced. Sizes as follows: Sills, 4x8 inches; posts, 4x8 inches; girths, 4x7 inches; plates, 4x6 inches, braced at angles and nailed to attic beams and rafters; braces, 4x6 and 5x6 inches; rafters, 3x7 inches, and 24 inches from centers, each pair to have a collar-board; ridge-piece to ridge; floor beams, 3x10 inches in first and second stories, 16 inches from centers, and cross-bridged between supports; ceiling joists in third story, 2x8 inches, spiked to rafters; trimmers and headers, 4x10 inches; studding (hemlock), 3x4 inches, 16 inches from centers, and bridged, double at all openings; partition-heads to every partition; floor beams rest on them. *Covering.*—Cover all roofs with hemlock boarding, well nailed. The walls there to be covered with best quality pine clapboards, neatly fitted, 4½ inches weathering; and the roofs to be covered with tin or sawed cedar shingles, with 5-inch weathering; have roll on ridge of roof. All outside finish to be of No. 2 pine stock, put up in best manner. *Finish.*—Eave moldings, belt courses, water-table, etc., to be all as shown on drawings, and carefully put up. The eaves to have a gutter sunk in top near the edge, in best manner. Plain moldings on edge and neat cantilevers underneath, every 2 feet apart, as shown. Corner-boards as shown on engravings. *Veranda.*—Veranda also as shown; 6-inch boxed and chamferred posts and plate, 3x5-inch rafters, 3x8-inch sill and cross pieces, and 2x8-inch joists; 1½-inch narrow flooring, laid in white lead; ceiling ceiled over longitudinally with narrow pine ceiling. Brackets, steps, lattice-work, etc., all as per drawings, and in best possible manner. Rear veranda of same general description, and as shown. *Bays.*—Bay-windows to be exactly alike in every particular; to be strongly made, neatly fitted up, and to be finished as part of rooms. Water-table of house breaks around them. Eaves, moldings, etc., as shown. The roofs of these, as well as of verandas, to be covered same as main house roof. *Gables.*—Gables to have verge boards, etc., as shown on front elevation; all to be put up in neatest manner. Turned wooden finial at each gable of main roof. Plain 4-inch window-sills to all windows. Window outside casings as shown in drawings. Any other outside finish not described, but necessary to finish job satisfactorily, is to be done and finished neatly.

Inside Work.—Cross-fur all ceilings, strings, etc., for lathing. Set all stud partitions shown, and do all furring required by the work. Frame for scuttle in main roof when directed by owner. Make scuttle curb and cover of plank; cover with tin; make movable, and fit with proper fastenings complete. Make step-ladder by which to reach it. *Floors.*—Floors in kitchen wing to be of narrow Southern pine floor-plank, tongued and grooved and 3 inches wide; blind nailed in best manner. Veranda floors the same. The floor in attic to be rough hemlock, tacked down. In all other parts of the house the floors are to be of white pine plank, 1 inch, tongued and grooved, blind nailed, and not over 4½ inches wide in any part. Put saddles to all doors. *Stairs.*—Stairs 2 feet 10 inches wide, and 10-inch treads, in best, strongest, and neatest manner; 6-inch turned walnut post at bottom, and two turned walnut balusters to each tread; 3x4-inch walnut rail, all in best manner; nosing and molding on edge of step. Cellar stairs under main flight, made strong but plain. Cellar stairs leading from dining-room to have a strong pine hand-rail, half round on upper edge. Upper stairs ceiled up on side, enclosing stairs to cellar, all neat and complete. *Trimmings.*—All inside finish to be of best clear white pine. Architraves in first story main house to be 6 inches wide, with plain moldings; in all the rest of the house 5½ inches wide, with same moldings. The base may be 9½ inches high, with neat moldings throughout house. The architrave to double doors must be 6½ inches wide. Windows not running to floor are to be finished neatly with nosing and molding. *Windows.*—Windows as follows: Those in cellar to be made to swing; three lights of ordinary glass in strong frames; sash 1½ inches thick; good fixtures and fastenings complete. All other windows to have outside rolling blinds, 1x1¼ inch thick; to have four panes of double thick French first quality glass; hard wood sills, and best French window fixtures and fastenings, fitted up in first-class manner; 1¾-inch sash. *Doors.*—Doors to be as shown, with sizes given on plans. Outside cellar door made inclined, and hung to heavy frame of seasoned chestnut. Door battened and made perfectly tight, with fastenings complete. Front door hung in halves; vestibule door 2 inches thick, to have circular heads and glazed with double thick ground glass in neatest manner; door 2¼ inches thick, and to be fitted with all usual fixtures and fastenings in best manner; white porcelain trimmings. Vestibule and all other doors in house to be four-panelled and molded. The closet doors may be single faced and have rim locks, but all others must be double faced and have mortise locks; all to have porcelain trimmings; all other fixtures to be the best make and style. One pair of double doors between sitting-room and dining-room, each half four-panelled, and to have all necessary fixtures. Closet doors 1¾ inches thick, all others 1⅜ inches. *Fittings.*—In kitchen fit up two wash-trays in white lead; 2-inch pine plank; each tray to be 2 feet 8 inches by 1 foot 10 inches by 1 foot 4 inches, all complete with covers. In kitchen fit up a 5-foot dresser, 6 feet high and 16 inches deep, with cupboard doors below and open shelves above. Case around sink in usual manner, and 3 feet high behind it against the wall. Put a wainscoting of narrow black walnut and yellow pine on all sides 3 feet 2 inches high, and finish at top with a narrow molding; same to be done in bath room. In pantry fit up shelving and cupboards, the latter on one side of room, and shelves on the two other sides, as shown in drawings. Fit up the two closets between sitting-room and parlor with 14-inch shelving, as shown in drawings and directed by owner. In second story fit up the hall room as a large linen closet with 14-inch shelving on two sides, as directed in drawings, all strong and neat; three drawers in this closet. In bath-room fit up in neatest manner a tub, bowl, and water-closet; use black walnut and yellow pine as above specified; put door in front of bowl, and case up 2 feet behind tub. Case all pipes that show, in neatest manner. Build tank in attic as directed. Fit up a bell from front door to kitchen, and also one from chamber (as directed by owner) to kitchen; have copper concealed wire connections, in best manner. *Tinning.*—Do all tinning and flashing necessary to make the roof, etc., tight. The contractor must warrant this. Line gutters in careful manner, and empty at ends in 3½-inch galvanized iron leaders, to take water to leaders in ground; good connections. Flash around chimneys.

Plumbing.—The plumbing in this work is to be first-class in every respect, and is to include all fixtures, etc., complete, and in good working order. Plumber to put in his work at such times as the work may demand. Put up a force and lift pump to draw water from cistern and force it into tank. *Boiler.*—Furnish and fit up in kitchen a 40-gallon tinned and planished boiler on stand, in best manner and with all usual appliances; make all connections complete. *Sink.*—Fit up a 24x36-inch cast-iron sink on iron legs; furnish with hot and cold water in most complete manner; to have brass cocks, plug-chain, trap-waste, etc. *Trays.*—The wash trays are to be supplied with hot and cold water in usual way; brass finished cocks, waste overflow, plugs, etc., all complete; trap waste. *Tub.*—Bath-tub to be 4½ feet long, lined with 14-ounce copper; to have plated cocks, plug-chain, etc.; waste to be trapped in best manner. Connect with soil-pipe. *Water-Closet.*—Water-closet to be plain cast-iron, with a cock at side; to be fitted up in best manner, complete and in best working order. Supply with water, and have 4½-inch soil-pipe, properly trapped. *Bowl.*—Wash-bowl 14 inches in diameter, marbled, in slab 1¼ inches thick; supply with hot and cold water; plated cocks, plug-chain, etc.; waste trapped in best manner; connect with soil-pipe; 10-inch marble back. *Tank.*—Line tank with 5-pound lead in best manner; solder and button well; fire-cock, overflow, tell-tale, and circulating pipe all complete. Tank to be 3 feet wide, 3 feet deep, and 7 feet long. Arrange suction-pipe to soil-pipe to prevent its being sucked dry. Pipes from cistern to cellar, with stop-cock.

Gas-Fitting.—Run ¾-inch iron pipe for chandelier in center of parlor ceiling and hall, and for brackets in kitchen, dining and sitting rooms, and in front and back rooms of second story, all to be of the best material and done in a workman-like manner. *Fence.*—350 feet of picket fencing, chestnut post, and pine pickets, finished on the outside with molding below and above; to be 3 feet 6 inches high, and posts set 2 feet in ground.

Painting not to be included.

Miscellaneous and Advertising.

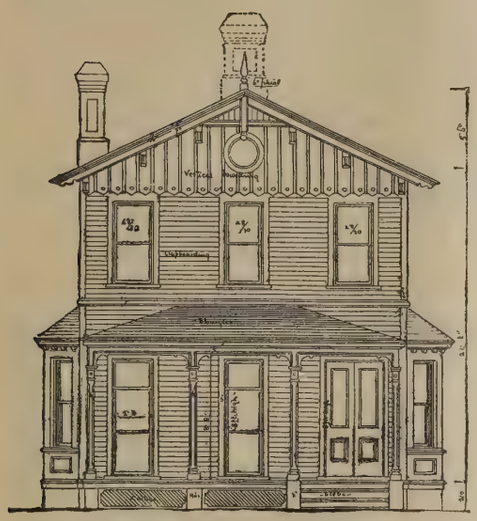
Latest and best books on steam-engineering. Send stamp for catalogue, F. Keppy, Bridgeport, Conn.

The manufacture of insulated telegraph wire has been commenced at the National Tube Works, McKeesport, Pa.

Mr. J. C. Hutchings has retired from the firm of A. J. Bicknell & Co., the architectural book publishers of this city, and Mr. W. T. Comstock has been admitted as a partner. The business is continued under the firm-name of Bicknell & Comstock.

One of the cheapest and most simply constructed pumps that has come under our notice is the steam jet pump made by Moore & Kerrick, of Indianapolis, Ind. These pumps are adapted for filling tanks from wells and other bodies of water for stationary or portable engines. They are made in iron and brass, and the prices range from $10 to $20.

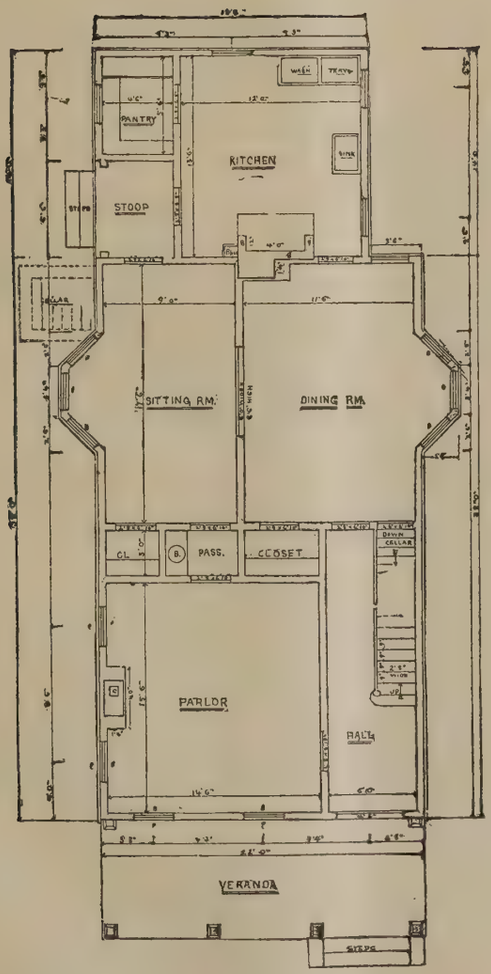
AN AGE OF SURPRISES.—We are constantly hearing of some new and wonderful invention or discovery, such as the telephone, phonograph, electric light, etc., which tends to revolutionize all the old-fashioned ideas of what is what. The principal drawback to the use of these new appliances has been the considerable outlay necessary for their introduction; but this difficulty as regards the telephone has been satisfactorily overcome. A Boston firm has succeeded in producing an instrument that works one mile, which they are able to sell for $3 complete. A description of the invention will be found in our advertising columns.



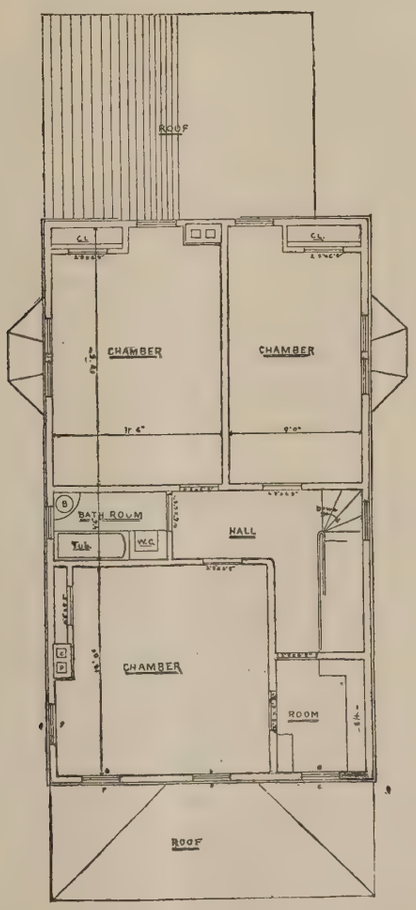
FRONT ELEVATION.

SIDE ELEVATION.

Scale, 12 feet to the Inch.



First Floor Plan.



Second Floor Plan.

DESIGN FOR DWELLING-HOUSE COSTING $3,000.

The Michigan Salt Works.

CONTINUED FROM PAGE 18.

The evaporation of salt brine by the steam process is now producing the largest portion of salt made in Michigan. In describing the arrangements of a steam salt block and the accompanying process, we have selected the steam salt block, drill-house, cisterns, and saw-mills of the Buffalo Salt Company.

This steam salt block is 140 feet long, 122 feet wide, and has an elevation of 52 feet to the top of the elevator; the elevator is 16 feet in hight. Included, therefore, in the above space are the inside settlers, grainers, salt-bins, and packing-room. The inside steam settlers are 136 feet long, 9 feet wide, and 6 feet deep, made of 4-inch plank, well keyed together and tightly calked. This block is supplied with seven grainers, 136 feet long, 7½ feet wide, and 16 inches deep. Over each grainer are the draining-boards running the entire length. Passing through each settler and grainer, and near the bottom, are 4-inch galvanized tubes, from four to five in number, depending on the size of the grainer, through which exhaust or live steam is forced.

In the steam, as in the kettle process, the brine is first pumped into the outside settlers, where it is partially settled. It is then drawn into the inside steam settlers, where it is heated up by the steam-pipes and brought to saturation—that is, a point just preceding the formation of salt crystals. It is then allowed to remain until all sediment of iron has fallen to the bottom, by which time it has become clear as crystal.

The brine is now ready to be drawn into the grainers, which are filled to about two-thirds their capacity, or nearly full. As the settled brine comes into the grainers quite warm and fully saturated, it soon commences to make salt, which forms on the surface of the brine and then falls to the bottom of the grainers. when a new lot of crystals are formed, to fall in the same way. The brine is also occasionally stirred, so as to make the crystals fine. Thus the evaporation continues for twenty-four hours, the temperature being kept at from 170° to 175° Fah. The brine being sufficiently evaporated by this time, the workmen commence the "lifting." This is done by first washing the salt in the brine that is left in the grainers, and then taking it out with shovels and throwing it on the draining-boards, where it remains for a number of hours for drainage.

A large "lift" or "draw" fills the boards with salt, and it is a beautiful sight to see the salt as it comes white and sparkling from the brine. The salt should remain on the draining-boards, to drain thoroughly, twenty-four hours if possible, before going to the bins. It lies in the bins two weeks to complete the drainage, when it is ready for inspection and barrelling for shipment.

The first requisite for solar evaporation of the brine is to have a series of covers or wooden vats. The covers are rectangular in shape, being 16 by 18 and from 6 to 8 inches deep. They are raised on wooden supports 2 to 3 feet from the ground, and are arranged in sets or strings. Each cover has a movable roof, which can be run on or off to protect or expose the brine, according to the weather. At the end of the string of graining covers, somewhat higher and deeper, are the "strings" of settling covers, into which the brine is led from the store reservoirs or cisterns. No lime is used in settling the brine in this process, for in these deep rooms the brine absorbs a portion of oxygen from the air, by which means the carbonate of iron, which is dissolved in the recent brine, is converted into an insoluble peroxid of iron. In Syracuse a second series of covers is used to get rid of the gypsum, which separates or is deposited in the form of a crystal. As the quantity of gypsum is very small in the Saginaw brines, these rooms are now dispensed with.

As soon as there is a show of salt crystals, the first stage of the process is accomplished, and the saturated brine, known as "salt pickle," is ready for the last stage. It is then drawn into the salt room or draining vats, in which the salt soon commences to crystallize on the bottom of the covers.

One of the conditions required for a good, large-grained solar salt—which is most esteemed in the market—is that the bottom of the covers in the salt room should be as smooth as possible, rough surfaces favoring the deposition of numerous small crystals. It is also necessary to have the salt covers supplied with a sufficient supply of good pickle, so that the salt already deposited may always be covered. An exposure of the salt uncovered to the air favors the formation of new small crystals, and the addition of an unfinished or not sufficiently concentrated pickle produces the same effect. It is also important that the waste or exhausted pickle from which the greater part of the salt has crystallized should be discharged from time to time, as its presence not only impairs the quality, but diminishes the quantity of the salt deposited.

The time required for the evaporation of sufficient pickle to make a crop depends largely upon the weather, dry and clear weather being, of course, most favorable; six weeks or two months is the usual time. Three crops of salt a season is gathered, the first about the middle of July, the second in the early part of September, and the third at the end of October. The second crop is generally the best, as it is coarser than the others.

The crop of solar salt is gathered by first loosening it from the bottom of the "covers" with a rake or spud. It is then washed in the pickle that is still left in the covert and "gathered" to the street gunwale. Here it is shovelled into draining tubs, to remain a short time before being emptied into the salt carts for removal to the salt bins for further drainage. The regular time—fourteen days—required for drainage having passed, the bins are opened and the salt is packed in barrels holding five bushels, or 280 pounds, each barrel being branded with the name of the firm or person manufacturing the same.

In regard to a successful and profitable production of salt from brine which is pumped up from great depths, the manufacturer should ever be on the lookout for leakages in the tubing or pumps. These may and do often arise from a jarring of the tubing by running the pump faster than the supply of brine comes to the pumping chamber, causing a vacuum and producing the so-called pounding of a well. The capacity of a well has been very materially affected by such a leakage, increasing the expense of pumping from 50 to 100 per cent. The supply capacity of a well is also very materially increased by the position of the pumping chamber in the well. In the early history of salt wells in Michigan, the pumping chamber was generally placed a short distance below the offset. More recent tests go to prove that the best location for the pumping chamber is at or very near the point where the largest supply of brine comes into the well, and that point is the lower portion of the sand rock, or within a short distance of the bottom of the well.

In pumping a well, it is also important that the weight of the pumping rods should be evenly counterbalanced by a weight on the other end of the walking-beam; this relieves the engine, the only weight to be lifted being the brine.

The stroke of the piston in the pumping chamber should be made as long as possible, and the motion of the engine should not be over 32 revolutions to the minute. In this way about the entire supply of brine in the well is obtained without forming a vacuum, thus preventing the pounding of the well and the danger of parting the pumping rods.

We have mentioned these details, as they contain useful hints in regard to the success of pumping works of whatever kind.

IMPORTANCE OF COOL-GRINDING OF FLOUR.—Mitcherlich and Crocker showed that wheat in which sugar was proved to be absent before sending it to the mill, yielded, after being ground, four per cent of it. Starch was thus transformed into sugar, which could not be done otherwise than through the internal action of the gluten aided by air and superabundant moisture. The mutual action of the gluten and the natural moisture of the flour seem often capable, at common temperatures, of slowly bringing about this injurious change. But when the flour comes out hot from the stones and is left to cool gradually in large heaps, decomposition quickly sets in, starch is changed to sugar, and (when kept warm long enough) the sugar into alcohol, while if the temperature is continued long enough above 60° Fah., it advances rapidly to the souring stage. These facts form a strong argument in favor of cool grinding.

New Publications.

A History of the Growth of the Steam-Engine. By Robert H. Thurston, A. M., C. E. New York: D. Appleton & Co.

This work embodies the most interesting portion of lectures given by the writer at the Stevens Institute, Hoboken, and which, for the purpose of this publication, he has reviewed, rearranged, and extended. The subject is grand, being a review of the gradual evolution of the proudest achievement of man—the conversion of heat into power by the intervention of watery vapor. The book is divided into eight chapters; the first treats of the steam-engine as a simple machine—as a curiosity, as it was at its birth, and finally as a moving attachment, doing work; the second chapter considers it as a train of mechanism; the third, its evolution to the modern forms; the fourth and fifth, its application; the sixth, the refinement of the present day; the seventh and eighth, its philosophy. The last two chapters contain much original matter relating to the reduction of the immense waste of heat, which remained a long time unpublished, and is highly important for all who intend devoting their attention to future improvements, showing them in what direction success may be hoped for.

All engineers should make themselves acquainted with the contents of this valuable book, which will elevate them to the right estimation of their own profession, which many are sadly in need of.

How to Read, and Hints in Choosing the Best Books. By Amelie V. Petit. New York: S. R. Wells & Co.

This book contains, besides the information announced in the title, an extensive classified list of works on Biography, History, Criticism, Fine Arts, Fiction, Poetry, Religion, Science, Language, etc., and may be considered as an earnest effort to meet a public demand for a compact manual or treatise supplying information with regard to books and authors. People who have not read much, people who are desirous of obtaining trustworthy advice with regard to the selection of books suitable for their children's reading, people who are interested in the collection of books for personal or public purposes, societies that are forming libraries, and, in fact, all who are interested in books, will find in "How to Read" very important aid. Not only does it contain the titles of thousands of volumes on nearly all the subjects currently discussed in the English language, but also has carefully prepared criticisms of many authors of eminence, dead and living, and useful hints on books suitable for self-improvement. The author's aim has been to meet fully the common inquiries of reading people with regard to books and authors, and we doubt not that publishers generally will welcome the volume as a help in what is often a matter of much perplexity—to send a correspondent just what he wants.

The Dinner Year Book. By Marion Harland. New York: Charles Scribner's Sons.

The author of this book has already distinguished herself by former publications—"Common Sense in the Household," "Breakfast, Luncheon, and Tea," etc. The present book is chiefly intended to answer the so common and annoying question: "What shall we have for dinner?" It is a question often perplexing for a housekeeper. In this book it is answered, as for every day in the year a bill of fare is given, with instructions how to prepare every article. A glance at the various bills shows that, without being 25-cent dinners, they are by no means expensive, and yet satisfactory to any reasonable eater. Several colored plates illustrate the appearance of some select dishes, and the manner of arranging them on the table. In regard to the efficiency of the recipes given, we can testify that we have tried some of them with the utmost satisfaction, and can therefore recommend the book on the ground of the old saying that "the proof of the pudding is in the eating."

The Temperaments; or, the Varieties of Physical Constitution in Man, considered in their Relations to Mental Character and the Practical Affairs of Life, etc. By D. H. Jacques, M. D. New York: S. R. Wells & Co.

This is a work treating of a subject of universal interest. The temperaments are defined according to both the ancient and the modern theories and classifications. The views of the old medical schools are described, as well as those of the more recent systems. The writer discusses all the tempermental modifications and combinations usually met with, showing the configuration which is associated with the different types. The relations of temperament to occupation, marriage, education, training of children, choice of occupation, health, and disease, are entered into. An important and valuable feature is that of

the practical hygienic rules for correcting the unhealthful predispositions of certain tempermental conditions; and not the least interesting part of the book is that which is devoted to the temperaments as they appear in races and nations, and is illustrated with many portraits. Then there are studies in temperament, and a chapter on the temperaments in the lower animals, showing the effect of domestication and other conditions.

Notes and Queries.

This department is intended to furnish, for the benefit of all our readers, information on any subject of scientific or practical knowledge falling within the field of The Manufacturer and Builder. *All persons possessing additional or more correct information than that which we give relating to the questions, are cordially invited to communicate it to us for publication. We also request that all questions or answers be written on separate pieces of paper, and addressed to the Editor.*

QUESTIONS.

(2277) Making Canvas Water-Proof.—Is there any simple way of making canvas water-proof, without painting it with a coat of oil or rubber paint, and so injuring its pliability?—J. I., Factoryville, N. Y.

(2278) Cleaning Silk Dresses.—How can silk dresses be cleaned? I know it is done, and should like to know the best way.—S. D., Pottsville, Pa.

(2279) Bronzing Steam-Pipes.—What is the best sizing that can be used for bronzing steam-pipes, applying the bronze dry, and while the rods are heated? How can the bronze be mixed with the size so as to be used as a paint?—R. G. B., Waltham, Mass.

(2280) Why the Lengths of the Months are Irregular.—Why, in the establishment of our present calendar, was the month of February assigned a less number of days than any other month, when, as is obvious, that by assigning to each six months thirty, and thirty-one days respectively for leap-year, and thirty to seven months, and thirty-one to five for other years, would be much more simple and easy of calculation? Inventors of clock-calendars will appreciate the importance of this question.—W. H. B., Worcester, Mass.

(2281) Testing White Lead.—How can white lead, zinc white, and barytes be separated so as to find adulteration? also when ground in oil?—P. K., Yonkers, N. Y.

(2282) Furniture Polish.—Please inform me why muriatic acid and butter of antimony form ingredients of many furniture polishes.—P. K., Yonkers, N. Y.

(2283) Book on Soap.—Please give me the names of one or more books that would be reliable on soap-making.—P. K., Yonkers, N. Y.

(2284) Book on Paints and Varnishes.—Please give a list of books that would be useful and reliable on paints, varnishes, etc.—P. K., Yonkers, N. Y.

(2285) Can Concussions be Measured in Pounds?—About what force in pounds (approximately) do the driving-wheels of a locomotive strike the rails? What is the amount of concussion in pounds?—G. W. K., Georgetown, D. C.

(2286) Estimating Aerial Concussions.—What is the concussion of the air per square foot against vertical walls, produced by the air vibrations from quickly moving trains? Are they greater when the ground is frozen?—G. W. K., Georgetown, D. C.

(2287) Level of the Red Sea and the Mediterranean.—The difference in the level of the Red Sea and the Mediterranean, determined long before the completion of the Suez canal, must have caused a current through the latter when it was completed. However, I have not heard of this. Can you give any information on this point?—G. B., Oswego, N. Y.

(2288) The Most Powerful Disinfectant.—What is the most powerful disinfectant known? By answering this question you will much oblige.—H. D. E., Oakland, Cal.

(2289) Iron Plating by the Battery.—I can easily copperplate by the galvanic battery, using a solution of sulphate of copper for the bath, when a film of copper is deposited. In trying to plate with iron, I expected that by using a solution of sulphate of iron I would obtain a deposit of iron; but it does not work. Please inform me what the trouble is.—An Amateur Electro-Plater, New York City.

(2290) Making Vinegar.—Please give a recipe for making vinegar as cheaply as possible.—D. F., Endfield, Va.

(2291) Staining Wood.—Please give a few simple stains for wood.—G. T., Bohemia, Wis.

(2292) Varicose Veins.—Please inform an old subscriber what is the cause and best remedy for the swelling of the veins in the legs, with which I am beginning to be much troubled.—R. D., Bridgeport, Conn.

(2293) Prevention of Hydrophobia.—I send you the following clipping from a paper: "The virus, or poisonous quality of the saliva, is of an acid nature. The immediate application to the wound of such an alkali as ammonia will neutralize it. Spirits of camphor will also kill the germs of the disease." I take the liberty of asking your opinion on this.—R. M., Brunswick, Me.

(2294) To do up Shirt Bosoms.—I am a young housekeeper and a novice in the manner of doing things about a house. I make many sad mistakes, but the principal annoyance comes from not being able to do up my husband's shirts satisfactorily. Will you kindly inform me how I can give the bosoms of the shirts the beautiful appearance that new shirts have when bought at our stores?—C. D. L., Jersey City, N. J.

(2295) Ambergris.—Please inform me what ambergris, used as a toilet perfume, comes from.—J. T., Catskill, N. Y.

(2296) Infringing Patents.—Can I make for my own use an article that is patented, without buying the right?—F. M. S., Newark, Ohio.

(2297) Glossy Black Polish.—Will you please give me some information in regard to making a glossy black polish for the purpose of polishing the stands of glass shades.—T. H. H., New York City.

(2298) Staining Bricks Red or Black.—Can you inform me how to stain bricks a permanent dead black (without polish) at the least possible expense?—Anxious Brick-Maker, Zanesville, Ohio.

(2299) Syrup of Barley.—On page 187 of your August number for 1873, in an article entitled "Home Brewery," one of the ingredients for beer is "Syrup of barley." I have tried the principal druggists of New York and Philadelphia, but none of them seem to know what it is—at least I cannot get any. What is it? Where can I buy it? Or how can I make it?—E. B. W., Mont Alto, Pa.

(2300) Making Acetic Acid.—As I intend manufacturing acetic acid from native and common vinegars, will you please give me the title of a good practical book on this subject.—C. F. C., East Cambridge, Mass.

(2301) New Method of Preserving Fruit.—What is the new method, now said to be practiced in England, for preserving fruit?—A. R., Jetersville, Va.

(2302) Introducing the Electric Light.—Since your polite reply in regard to electric light, I have been requested to procure for our Common Council the best dynamo machine and light for exhibition, with the view of lighting our city of 7,000 inhabitants, and displacing gas. We have power centrally located. As a reader of your journal since its commencement, allow me to ask your advice as to what I shall get, and to whom I shall apply to best accomplish my purpose. Our gas lamps now burn all night. This I supposed could not be accomplished except by incandescence; but of course you will know best.—R. W. S., * * *

(2303) Cheap Galvanic Battery.—How can I make a cheap, good and constant galvanic battery?—D. J., Charleston, S. C.

(2304) Harmless Hair Dye.—Can you give me a recipe for a hair dye that is not injurious? If so, you will oblige.—T. C., Fairmont, Minn.

REPLIES.

(2277) Making Canvas Water-Proof.—It is very easy to make canvas water-proof, without altering its appearance or pliability, by saturating it with a boiling and strong solution of soap, pressing out the excess of this, and then submitting it for a short time to the action of a hot bath of alum, sulphate of aluminum, or acetate of lead, which operation causes the formation of an insoluble alumina or lead soap, which will permeate all the pores of the texture and make it water-proof.

(2278) Cleaning Silk Dresses.—We do not know which is the best way, but potato-water is highly recommended. The recipe is this: Grate potatoes into clear, cold water—a large potato to every quart of water, of which five or six will do for a couple of dresses. If for very light silk, pare the potatoes, but in any case wash them clean. The pan of water must not be stirred in the least for forty-eight hours; then very slowly and steadily pour off the clear liquor (but not a particle of the sediment) into an open vessel, dip the pieces of silk into this liquid up and down a few times, without in the least creasing them; then wipe them on a flat table with a clean towel, first one side then the other. After each piece is dipped it should be hung upon a line, to allow the drops to drain off a little before wiping. Iron one way on the soiled side.

(2279) Bronzing Steam-Pipes.—There are two ways of bronzing; one is to mix the bronze with a clear varnish and apply it with a brush; the other is to varnish it first, and while sticky dust over the bronze. Both may be done with success, but as some bronzes act as a powerful dryer, you must not mix more varnish with the bronze than you are going to use at once, as it soon sets very hard. The varnish used may be copal, damar, shellac, or any other suitable for the purpose. We have employed both methods with equal satisfaction, but never for hot steam-pipes; for these you must try for yourself which way suits best. Nothing is as useful as experimenting, so we say—try.

(2280) Why the Lengths of the Months are Irregular.—The study of the history of the way in which this Julian chronology became established, gives the explanation of how the irregular lengths of the months were adopted. The original way (established by Julius Cæsar, the Roman Emperor) was as you propose, every other month alternately a length of 30 and 31 days, which gives for the twelve months 366 days—the length of a leap-year. As the true or astronomical beginning of the year is the month of March, when the sun enters the first sign of the zodiac—Aries, and spring commences, the superfluous day for a common year was taken from the last month, February, and this was made a day shorter, and the length of the months thus: March, 31; April, 30; May, 31; June, 30; July, 31; August, 30; September, 31; October, 30; November, 31; December, 30; January, 31; February, 30 days for a leap-year, and February 29 days for an ordinary year. When, after the death of Julius Cæsar, Augustus became Emperor of Rome, he did not want the month—August—called after him to be a day shorter than the month July, called after his predecessor, so he decreed that August should also consist of 31 days; but as there would then be three months of 31 days in succession, he reversed the order, and in place of September, 31; October, 30; November, 31; and December, 30, he made it September, 30; October, 31; November, 30; and December, 31; but he still had a day too many. As religious considerations prevented him from curtailing Januarius from 31 to 30 days, he took the day again from the last month of the year, Februarius, and made it 29 days instead of 30 for a leap-year, and 28 days instead of 29 for an ordinary year. The irregularity thus inaugurated has often been the cause of complaint, but it was found impossible to change the system after it had been established, and it appears that we will have to submit to this inheritance as well as our posterity.

(2281) Testing White Lead.—When dry, the baryta is easily discovered by its insolubility in nitric acid, which will dissolve white lead, as well as the other adulterants, zinc white and chalk. The chalk may be detected in this solution by oxalic acid or oxalate of ammonia, which will precipitate all lime compounds. After the lead has been precipitated by sulphuretted hydrogen, the zinc is best detected by the blow-pipe, placing the paint in a cavity scooped out in a piece of charcoal, and directing the flame upon it. The zinc will show its presence by its volatility, as it will stain the charcoal around the spot with a yellowish or white pulverulent deposit. When the paint is ground in oil, the only way is to burn it up on charcoal by the blow-pipe, in the manner just described. The sample tested should not be larger than a small pea, and the flame continually applied for about two minutes, frequently turning the mass around with the point of a spatula, so as to burn out all the oil. If it is pure white lead it will be reduced to a globule of metallic lead, while all the rest will have disappeared. If zinc white is present, the white stain referred to will show itself; if adulterated with baryta, a white, infusible, irreducible mass will remain behind. In this way it will be found that the cheapest kinds of what is sold for white lead, contain no trace of it, but consist chiefly of sulphate of baryta, chalk, and a little zinc white.

(2282) Furniture Polish.—Because they stain light woods brown. Butter of antimony especially possesses this quality, and will even color iron brown, being the principal ingredient used for browning musket-barrels.

(2283) Book on Soap.—"A General Treatise on the Manufacture of Every Description of Soap," by Prof. H. Dussauce, price $10; "The Manufacture of Soap and Candles," by Adolph Ott, price $1.50, either of which we can furnish postpaid.

(2284) Books on Paints and Varnishes.—The most complete are Riffault's "Practical Treatise on the Manufacture of Colors for Painting," price $7.50, and "The Painter, Gilder, and Varnisher's Companion," price $1.50, either of which we can furnish postpaid.

(2285) Can Concussions be Measured in Pounds?—Answers to such questions can never be approximately correct, because the stroke produced by a moving mass is not comparable with mere weight. We hold that the expression "force in pounds," is absurd, as pounds at rest cannot measure or express a force. For the exertion of force motion is necessary, hence force can only be measured by velocity and mass combined, such as one ton moved ten feet, or one pound moved one foot, or a foot-pound. This is a measure for force, but pounds, or mere weight alone, cannot express it. Weight will, to be sure, exert a pressure, but pressure is not force, and this is the mistake under which many would-be inventors labor, especially those who seek for perpetual motion. Pressure can become a force when motion results, and is only a force as long as the motion lasts. In regard to the question, it can only be said that the concussion of the wheels of a swiftly moving locomotive may be compared to a hammering of the rails by a mass which has a certain proportion to the weight of the locomotive or car, velocity of revolution, and size of the wheel. It is evident that the larger a wheel is the more gradually it comes down on the rail, so that the smaller the wheels are the more violent the concussion they cause. It would be easy enough to pretend that this concussion can be expressed in pounds, and to state that it is equal to say 20 tons, but such a statement would be of no value whatever. Even if it were possible to answer such a question, the way in which you put it makes it utterly unanswerable, as you give neither the weight of the locomotive, its velocity, nor the number or size of the wheels.

(2286) Estimating Aerial Concussions.—This question is as impossible to answer as the preceding one, and if any one pretends to be able to solve it, and to say that it amounts to say 1,000 pounds per square foot, we say it is a false pretence. There is no theory on which the actual pressure of sonorous vibrations can be estimated in mere weight, as such shocks are not measurable in pounds. One thing is certain, which is that when the ground is frozen its want of elasticity makes the rails more immovable, and the cars may obtain greater jarring in proportion; on the other hand, if the ground is very soft, so that the rails give way under the weight, they may cause a greater oscillation of the cars; so that it appears that a moderately elastic ground is the best to secure a minimum vibration. This has been verified by experiments with a section of the Metropolitan Elevated Railroad in this city, by placing elastic

supports between the rails and their supporting beams, which considerably diminished the noise. In this structure the ordinary noise of railway trains was chiefly increased by the vibration of the whole iron structure on which the road is supported.

(2287) Level of the Red Sea and the Mediterranean.—It has turned out that the two seas are at the same level, and when the levels change temporarily, then the lakes which lie on the course of the canal become great receptacles and regulators, in which much of the water of the two seas is stored up. The winds have the greatest influence. When they blow west and northwest, they raise the waters of the Mediterranean and depress those of the Red Sea; but the difference amounts to only about 16 inches, which is generally in September, and then a current sets in from the Mediterranean, which is interrupted at the flood tides in the Red Sea, but which, for all that, carries a quantity of water, estimated at 2,000,000,000 cubic feet, to the Red Sea. In the winter season the winds blow in the other direction, and the same amount of water is carried from the Red Sea to the Mediterranean. The saltness of the water in the lakes referred to, which before was very great, is diminishing by these currents, and finally they will become the same as the ocean. They were called bitter lakes, as the water was very bitter, containing much more magnesium salts than the ocean.

(2288) The Most Powerful Disinfectant.—One disinfectant will be the most powerful for one thing, and another will be better for another object; thus, for instance, frost is perhaps the most powerful disinfectant for yellow fever, and for many other miasmata, but it is no disinfectant at all for smallpox. Permanganate of potash is perhaps the most powerful disinfectant for a foul breath, and also for sewer-gas, if only applied in abundant quantity; but here is the difficulty, it is next to impossible to make it reach every spot where it is needed. Cesspools require various disinfectants, according to the condition of the material; when there is a great deal of urin in them, and they evolve a smell of ammonia, chlorin gas is best; in other instances quicklime will be better; alum, chloralum, bromalum, sulphate of iron, charcoal powder, chlorid of lime, sulphurous acid gas, nitrous acid fumes, chlorid of zinc, sulphid of zinc, sulphate of zinc, iodin, bromin, and even simple earth have been applied with satisfactory results. For sick rooms chlorin is objectionable, but carbolic acid, creosote, and salicylic acid have been successfully employed. Perhaps ozone is as powerful as any, but it is objectionable in some cases, as it produces an irritation in the mucous membranes of the throat. This substance is produced in its mildest form by the flavor of flowers, and of ethereal oils, such as lavender, bergamot, etc., hence the beneficial effects of perfumery in sick rooms. The old idea that such agreeable odors only hide the bad ones is erroneous; by their action upon the air small quantities of ozone are produced. The agreeable impression of these odors upon the olfactory nerves, is a provision of nature to induce man to increase such odors, in the same way that disagreeable odors of decaying matter is a warning that they are injurious and should be avoided. An abundance of flagrant flowers in a room where a dead body is kept, is a praiseworthy custom, as they effectually destroy the odor and diminish the dangers of infection to which otherwise visitors present might be exposed. It will be seen from what we have stated that there is no disinfectant that can be called the most powerful in all cases—the choice is a matter of knowledge and judgment.

(2289) Iron-Plating by the Battery.—If you were a professional electro-plater, or if you had tried silvering and gilding by the battery, you would know that every metal requires its own peculiar way of making the solution. For copper the simple solution of the sulphate is sufficient; for nickel it will not do at all, hence the complicated law-suits at present in regard to a patent for what is claimed to be the best preparation for the solution, (but which, by the way, is by no means the best); for iron it is necessary to use a double sulphate and tartrate of iron and potash or soda. The way to prepare it is this: First solution—4 ounces of yellow prussiate of potash and 8 ounces of tartrate of soda are dissolved in 5½ pints of water; second solution—1¼ ozs. of sulphate of iron are dissolved in 1¼ pints of water; add the second solution to the first; when mixed, pour in gradually a solution of caustic soda. At first a blue precipitate is formed, which is Prussian blue; but continue adding soda until the Prussian blue is dissolved again, then stop, and the solution is ready for use as a bath for depositing iron on other metals.

(2290) Making Vinegar.—Of all the various ways of making vinegar, we think that made by the fermentation of molasses the cheapest. To produce this, mix every gallon of molasses with from 8 to 10 gallons of water, put in about half a gallon of brewers' liquid yeast, and let it ferment for a few days at a temperature not below 65° Fah. When the fermentation has stopped, and the liquid has clarified by precipitation, draw it off, and it will be found to be very good vinegar. You may also make vinegar by letting diluted spirits flow slowly over wood shavings, placed in a perforated barrel; but this method is much more expensive.

(2291) Staining Wood.—A red stain will be produced by a solution in dragon's blood in spirits of wine; black by a very strong solution of nitric acid, to which you may add some strong sulphuric acid; green by a solution of verdigris and nitric acid. If the wood, when stained green with the last solution, is dipped into a hot solution of pearl-ash, a blue stain will be produced. A solution of sal ammoniac and nitric acid will produce a purple stain in most kinds of wood, while diluted nitric acid will stain yellow.

(2292) Varicose Veins.—The cause arises from obstructions in the circulation of those channels of the blood which return it upward to the heart. These channels are the veins which lie close to the skin, while the arteries which supply the blood downward are situated interiorly near the bones. The obstructions referred to are, in the first place, habitual costiveness. If you keep your intestines free and as empty as possible by a proper diet of fresh fruit and vegetables, and, if need be, an occasional purge, it will go far toward curing you of the trouble you refer to. The second cause comes from tight clothes, especially around the waist. This mistake is often commited by men who do not wear suspenders, and by tightly closing bands over the hips cause a continuous and injurious pressure over the region of the liver. The same error is also committed by women who wear tight corsets, by which the abdominal viscera are pressed downward into the pelvis, and thus cause as much pressure on the veins passing there as is caused by constipation, which gorges the intestines. Another cause is tight or elastic garters. These should never be worn by children, as the stocking can be perfectly well kept up by the attachment of elastic straps to the waistband. If elastic garters are worn at all, they should be applied above the knee, and not below, where they obstruct all the superficial veins.

(2293) Prevention of Hydrophobia.—We read of this same remedy twenty years ago. If it was really what is claimed for it, hydrophobia would long ago have ceased to be a so much dreaded disease. It has probably obtained its reputation in the same way that many other useless remedies have. A person who has been bitten by a dog, puts ammonia or camphor spirits on the wound, he does not get hydrophobia, and thinks that the ammonia or camphor prevented it, while the true cause is that the dog was not mad.

(2294) To do up Shirt Bosoms.—We sympathize with our young correspondent in her domestic difficulties, and will endeavor to help her out of the dilemma in the particular case she asks about. For doing up shirt bosoms, we think that the following recipe will give our correspondent the appearance to her husband's shirts that she wishes to impart to them: Take 2 tablespoonfuls of the best starch, add a very little water to it, and rub and stir with a spoon into a thick paste, carefully breaking all the lumps and particles. Add a pint of boiling water, stirring at the same time; boil half an hour, stirring occasionally to keep it from burning. Add a piece of "enamel" the size of a pea; if this is not at hand, use a tablespoonful of gum arabic solution, (made by pouring boiling water upon gum arabic and letting it stand until clear and transparent), or a piece of clean mutton tallow half the size of a nutmeg; a teaspoonful of salt will do, but it is not as good. Strain the starch through a strainer or a piece of thin muslin. Have the shirt turned wrong side out, dip the bosoms carefully in the starch and squeeze out, repeating the operation until the bosoms are thoroughly and evenly saturated with the starch, then proceed to dry them. Three hours before ironing, dip the bosoms in clean water, wring out and roll up tightly. First iron the back by folding it lengthwise through the center, next iron the wristbands and both sides of the sleeves, then the collar-band; now place the bosom-board under the bosom, and with a dampened napkin rub the bosom from the top toward the bottom, smoothing and arranging each plait neatly. With a smooth, moderately hot iron, begin at the top and iron downward, and continue the operation until the bosom is perfectly dry and shining. Remove the bosom-board and iron the front of the shirt. The bosom and cuffs of the shirt, and indeed all nice, fine work, will look clearer and better if they are first ironed under a piece of thin old muslin. It takes off the first heat of the iron, and removes any lumps of starch.

(2295) Ambergris.—This substance is nothing else than the result of a fit of indigestion on the part of the sperm whale, being in fact a kind of intestinal calculus or portion of the food of the whale imperfectly digested. Foxes have a great partiality for ambergris, and congregate on the sea-coast in search of it. They eat and return it in exactly the same state as it was swallowed, in respect to perfume, though changed in color. This is the white ambergris so highly valued. After passing through the digestive organs it retains its delicate and subtle perfume, which rivals that of the fairest flowers.

(2296) Infringing Patents.—In order to answer this question you must define what you understand by the expression "for my own use." If you make and use the patented article, and the patentee cannot prove that you made any profit by its use, or that he suffered any damage by it, and you can prove that it was only made and used for experiment and not for profit, nor to damage the patentee, you are safe. If the contrary is the case, you are liable to prosecution. If any one makes a patented article and receives pay for it, he is liable to prosecution. You will find the legal proofs for this opinion on page 234 of our October number for 1873, which we can send you by mail on receipt of 20 cents.

(2297) Glossy Black Polish.—If the stands are of iron or metal, the best way is to japan them, the process for which you will find in the answer to Query 2257, published in our January number. If not made of metal, so that they cannot stand baking, we recommend a simple varnish of shellac, or other suitable kind, mixed with lampblack.

(2298) Staining Bricks Red or Black.—We suppose that a process similar to that used for staining bricks red, will answer for staining them black, by substituting lampblack for the red employed. The recipe for the red color is to melt 1 ounce of glue in 1 gallon of water, and add a piece of alum the size of an egg, then ½ pound of Venetian red, and 1 pound of Spanish brown. Put a little on the bricks and let it dry, so as to see if the color suits you; if too red, add more brown; if too brown, add more red. For staining black, we recommend the same—1 ounce of glue in a gallon of water; instead of alum, you may add the same quantity of bichromate of potash, which will make the glue more insoluble in water than alum will; but you must preserve it in the dark. Then add one pound of bone-black, or a little less lampblack. When applied to the wall on a clear day, the daylight will make it insoluble, while it will have no gloss. Perhaps lampblack mixed with turpentine will do equally well. Lampblack mixed with benzine will not do as well, because when the benzine has evaporated, nothing is left to hold the lampblack together, while turpentine leaves a resinous residue as a binding material.

(2299) Syrup of Barley.—It is not surprising that you cannot buy it, as it is not for sale, because it cannot be kept, for the reason that it ferments very soon, besides there would be no demand for the article; so that you will have to make it yourself, which is very easy. In order to do so, take pearl barley, wash it first with cold and then with warm water; throw this water away, and boil the barley for several hours with a gallon of water for every quarter pound of barley; boil it down to at least half its volume, and strain. The strained syrup-like liquid is what you want to make the beer according to the recipe referred to. The barley left is good to eat, especially when sugar, milk and butter are added. If you have too much of it, you may use it for fodder, as animals are very fond of it.

(2300) Making Acetic Acid.—There is an extensive work on this subject, entitled "A Complete Treatise on the Manufacture of Vinegar, Theoretical and Practical," by Prof. H. Dussauce, price $5. This will give you the information desired, and a great deal more. We can send you the work, postpaid, on receipt of price.

(2301) New Method of Preserving Fruit.—We suppose you refer to the new drying process applied at present in England. It is done it this way: Pears, apples, and other fruits are reduced to a paste, which is then pressed into cakes and gently dried, and in this dried condition, they can, it is claimed, be kept for an indefinite period, if not exposed to dampness. When required for use, it is only necessary to pour four times their weight of boiling water over the cakes, allow them to soak for twenty minutes, and then add sugar to suit the taste. The cost of the prepared product is claimed not to be much greater than that of the original fruit, differing with the supply and price of the latter; the keeping qualities are excellent, so that it may be had at any time of the year, and bears long sea voyages without detriment, doing away with the loss so often suffered when it is attempted to preserve fruit fresh. The claim made for this process, that all the fine flavor of the fruit is retained, is certainly too sweeping. Everybody knows the difference between dried and fresh apples, and dried and fresh peaches. The reduction to a paste and the pressing into cakes, cannot certainly prevent this change of flavor.

(2302) Introducing the Electric Light.—Your Common Council is rather too fast in thinking so soon of lighting the city by electricity and displacing gas. There is no machine as yet made which we can conscientiously recommend for the purpose of lighting a city. Then, the best method of subdividing the light has not been settled; and as for illuminating a city you do not want a few very strong lights, but a great number of weak ones, you had better wait until this matter of subdivision is successfully accomplished. Finally, the real economy is as yet doubtful. The first inventors and patrons of electric lights have made claims for great cheapness and economy resulting from its use, which we have published; but now comes the other side, who attempt to prove that, after all, the economy is on the other side, and that gas is cheaper. So your city had better stick to gas until the question is settled.

(2303) Cheap Galvanic Battery.—Take a stone jar and a thin flower-pot of about the same hight, but only about half the width of the jar, close the hole in the bottom of the flower-pot with a plug, put a piece of sheet zinc around the flower-pot and a piece of sheet copper inside. Put crystals of sulphate of copper around the copper in the pot, and also a solution of the same; put outside the pot in contact with the zinc a weak solution of sulphate of zinc or sulphate of magnesia, when one cell is complete. This is a modification of the Daniel cell. In using several such cells, so as to form a battery, you can connect them in two ways; one is to connect all the zincs and all the coppers; in this way you obtain a great quantity of electricity, as they act as one single cell, of which the surface of the metals is square to the sum of that in all the cells. The second way of connecting them is to connect the copper of the first with the zinc of the second, the copper of the second with the zinc of the third, and so on. If you then take the wire coming from the zinc of the first cell and the wire coming from the copper of the last, (which wires are called the electrodes), they will give a current of greater intensity. It is clear that in this case the current of each cell must pass through every other.

(2304) Harmless Hair Dye.—We see it recommended to use 1 part of pyrogallic acid dissolved in a mixture of 2 parts of eau de cologne and 38 parts of distilled water. It is claimed that this will dye gray hair to a pleasant brown color, and that it is not injurious, which we believe.

THE MANUFACTURER AND BUILDER.

Vol. XI.—No. 3. MARCH, 1879. ELEVENTH YEAR.

Double Piston Balanced Engine.

Experience has for a long time demonstrated that there is a great advantage in reducing the size of steam-engines and increasing their speed in a proportionate ratio. For instance, instead of having an engine with a cylinder which at every stroke consumes say 2 cubic feet of steam, making two strokes in a second, and therefore consuming 4 cubic feet of steam per second, to have a smaller engine with a cylinder of 1 cubic foot capacity and drive it at the rate of four strokes per second, when it will also consume 4 cubic feet of steam per second. As said above, experience has decided in favor of the latter, hence the tendency of engine builders of the present day to build machines of high velocity. There is, however, a limit to this increase, caused by one of the inherent properties of matter, namely, the inertia of the piston, piston-rod, and connecting-rod, which, when put in very rapid to-and-fro motion, cause a strong jar of the whole engine frame, and even its foundation, making it unsafe to exceed a certain rapidity of revolution. To this must be added the intermittent reaction of the steam pressure on the cylinder, which adds its share to the alternately opposite strains of piston and cylinder heads, and is not corrected even when two cylinders are used, acting on cranks placed at right angles, in which there is always an oblique strain on the shaft, tending to twist it.

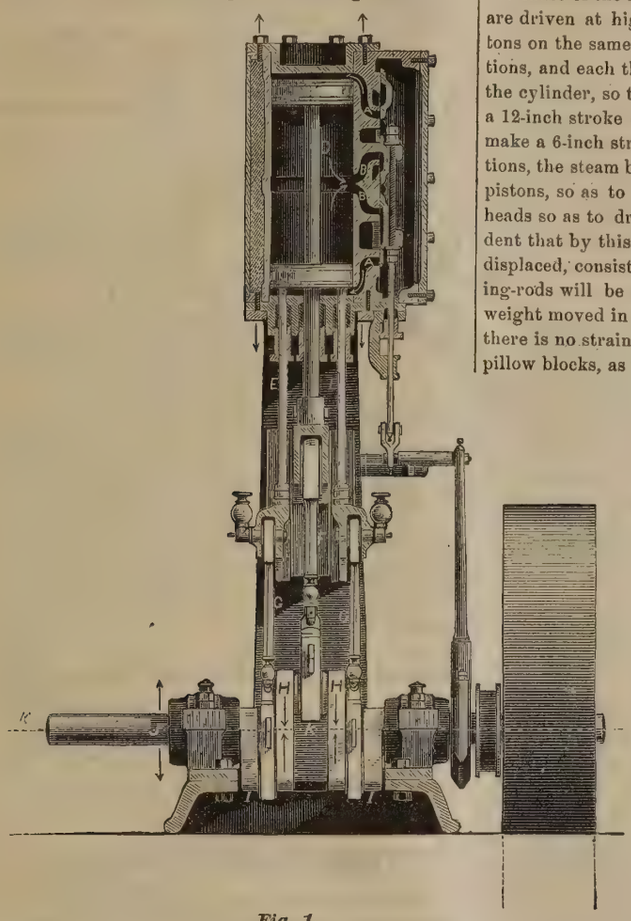


Fig. 1.

Mr. Justin R. Wells, of 86 and 88 Liberty street, New York, developed the fortunate idea of counterbalancing this inertia, and in this manner doing away with the cause of the shaking motion observed when engines are driven at high speed, by simply placing two pistons on the same cylinder, travelling in opposite directions, and each through a space of half the length of the cylinder, so that when the cylinder would admit of a 12-inch stroke of one piston, the two pistons would make a 6-inch stroke each time, but in opposite directions, the steam being alternately admitted between the pistons, so as to drive them apart, and at the cylinder heads so as to drive the pistons together. It is evident that by this arrangement the amount of weight displaced, consisting of piston, piston-rod, and connecting-rods will be balanced, there being just as much weight moved in one direction as in the other, while there is no strain whatsoever between the cylinder and pillow blocks, as the pressure of the steam on the two cylinder heads is always equal, hence this arrangement has been called by the inventor a balanced engine.

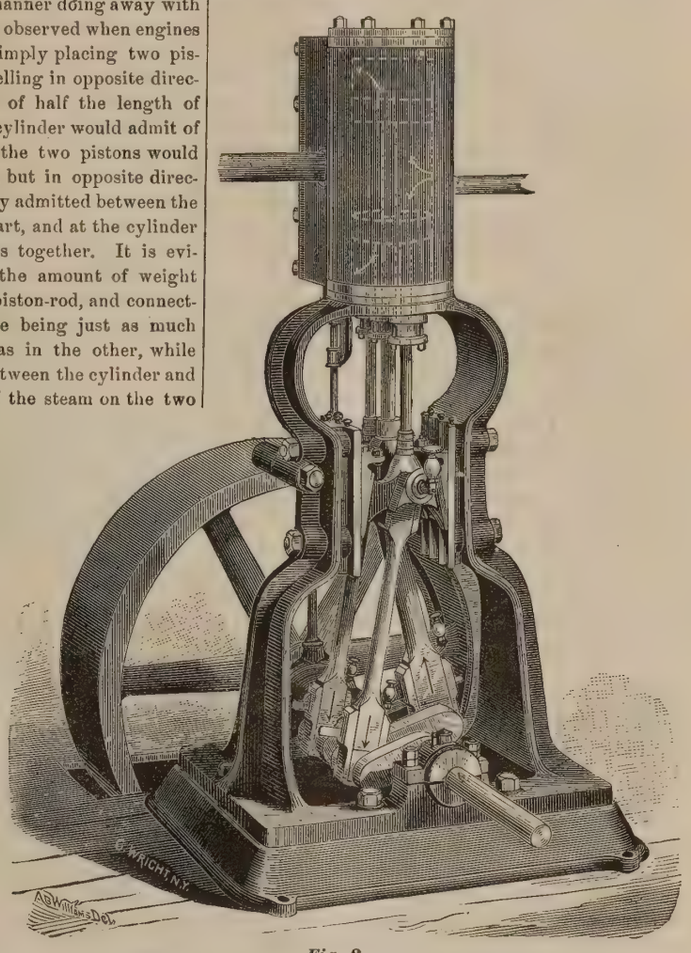


Fig. 2.

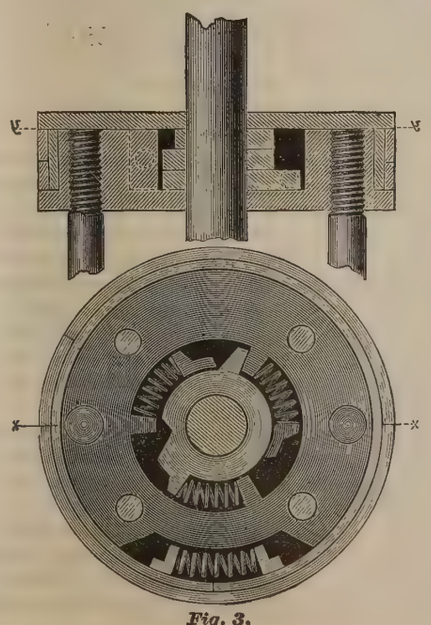


Fig. 3.

Another important advantage is also gained, namely, that the strain of the shaft on the journals is brought to a minimum. It is evident that by a single crank and piston there is an alternate pull and push of the crank on the journals, which tends to loosen and wear them out. When there are two opposite forces acting on cranks placed in opposite directions this strain is obliterated, as the two forces balance one another and simply turn the shaft without causing a tendency to twist it or an undue pressure on the journals—another ground for the claim that such an engine is balanced.

In order to make this clear to the reader, we give in Fig. 1 a vertical section of such an engine, as we saw it in operation at 86 and 88 Wooster street, New York, the establishment of Geo. K. Otis, the contractor for the city transportation of the United States mails A A and B B are the injection and ejection ports, C C are the piston heads, D is the middle piston-rod which works through the front piston head, E E are the outside piston-rods, F is the middle connecting-rod, G G are the outside connecting-rods, H H are the middle crank arms, I I are the outside crank arms, J is the shaft line, and K shows the center of action, or where the strains meet. Steam is admitted at both ends of the cylinder, simultaneously, which forces both pistons

to the center; steam is then admitted in the center, between the two pistons, which forces them back to the ends of the cylinder, completing the revolution. The middle piston-rod, moving through the stuffing-box in the front piston-head, is packed with metallic rings, automatically adjusted with springs, as represented in Fig. 3. The cut shows the ordinary D slide-valve, for which any preferable valve may be substituted, including link-motion.

That in such an engine the strain in the bearings is brought to a minimum, can be proved by removing the bed-plate, leaving the cylinder loose, or even by removing the pillow-blocks; when the shaft will remain stationary while the engine moves. In a single-piston engine the cylinder would be displaced, and even if two cylinders were used the shaft would be thrown from its bearings.

It is evident that as each of the pistons move only through half the space a single piston would have to move through, and as they move at the same time, they make, at the same velocity, the strokes in half the time, and that therefore with the same velocity of pistons they use twice the volume of steam.

Fig. 2 represents the exterior of the engine which we saw at the establishment above mentioned, and in regard to which we collected the following data from the engineer:

The cylinder has a 5-inch bore, and each piston a 5-inch stroke, or 10 inches combined; its section therefore is nearly 20 square inches. It was driven with a steam pressure of 60 pounds, which gives 1,200 pounds pressure on the cylinder, which, moving through 10 inches, gives 1,000 foot-pounds as the value of each stroke. This valuation, however, is based upon the assumption that the pressure on the moving and receding piston is the same as it is in the boiler. It was this that involved the old theoretical calculators of steam-power in the dilemma that the engines of which they made estimates scarcely ever possessed half the power thus calculated. It is by the use of the indicator that it is shown what the real pressure of the steam is on the piston during every part of its stroke, and it has been generally found by this that it is (especially in a rapidly moving engine) on an average only about half what it is in the boiler. Let us, for the sake of simplicity, value it at one-half, which would give for this engine 500 foot-pounds as the corrected value of each stroke.

We timed the engine carefully, and found it to make 400 revolutions per minute, which is 800 strokes, which we have to multiply with the value of each stroke—500 pounds—to find the value of the work done per minute—400,000 foot-pounds per minute, which, divided by 33,000 foot-pounds per minute, representing one horse-power, gives as quotient nearly 12 horse-power for the engine. If we test this estimate by the work actually performed by the engine, it is pretty well borne out. It cuts the hay and grinds oats and corn for the 120 horses that are employed for the daily transportation of the heavy mail wagons, while it also hoists the large elevators by which six horses at a time, and sometimes the mail wagons, are transported to the different floors of the five-story stable; which, by the way, is a model establishment in regard to the sanitary care taken of the animals.

If now we take into consideration the consumption of coal required to accomplish all this, we find that the economy is great. The consumption averages from 200 to 300 pounds of coal per day of 10 working hours, or 20 to 30 per hour, according to the work done, which of course varies. A consumption of less than 2 or 3 pounds of coal per horse-power, however, is certainly very favorable, especially for a small engine. It must be acknowledged that often the work actually performed does not amount to 12 horse-power; but, as an offset, the same boiler furnishes steam to the coils for heating three different rooms, which on cold days make up for the gain otherwise resulting when the engine neither hoists nor grinds, which however seldom happens.

The small size of this engine, the little space it occupies, and its light weight are other great advantages, of much importance in some cases, as in the building referred to, in which it stands on the top story, where a large, heavy engine would not be so safe.

Another peculiar advantage is also connected with a rapidly moving engine like this—that is, a circular-saw can be attached directly to its shaft. We understand that a mechanic has already taken advantage of this, and an engine has been built for this special purpose; no loss of power by transmission, no slipping of belts, or wear of the same. We call the special attention of all interested to this peculiar feature, as it will have a tendency to inaugurate a revolution in the manner of using circular-saws. It is also well known that, independent of the saw, the rapidly revolving pulley will have the capacity to transmit the power of the engine with a much smaller belt than a slower revolving pulley can. This is another favorable feature of rapid engines.

As might be expected, such rapidly moving engines must be especially adapted to drive dynamo-electric machines for the production of electric light, as these require a very high speed. It must be acknowledged, to the credit of our Russian naval visitors, that they were foremost in perceiving this and applying it practically, as certified by the following letter, of which the plain statement of facts (as every expert will be compelled to acknowlege) contains the highest praise that could possibly be given to a small steam-engine:

Everett House, Union Square,
New York, February 25, 1879.

Justin R. Wells, Esq., President Wells Balance Engine Co.

Dear Sir: The engines furnished by you for the cruisers fitted out in Philadelphia for the Russian government, and employed on board of them for the use of transmitting the motion to dynamo-electric machines, deserve our greatest approbation, as we have obtained through them the best results. We are running them 700 revolutions per minute, connected direct; and we have run them 900 revolutions per minute without caps on pillow blocks. Believe me, my dear sir, yours most truly,

L. P. Semetschrin,
Captain of the Russian Imperial Navy.

A. Khotinrvy, Lieut. Imperial Russian Navy.

With the following letter, we close the favorable notice which we have felt obliged in justice to give this engine:

Office of the Weston Dynamo-Electric Machine Co.,
286 Washington St., Newark, N. J., Feb. 27, 1879.

Justin R. Wells, 86 and 88 Liberty St., New York:

Dear Sir: We take great pleasure in recommending to all users of motive power your balance engine. Having tried and used in our business a number of engines made by various firms, we do not hesitate to say that yours is by far the best we have had anything to do with. Its great economy of space and fuel, its perfect steadiness under the most trying conditions, combined with its most excellent construction, insuring great durability, renders it, in our opinion, the best engine in the market. We very cheerfully furnish this testimonial as to its merits, feeling well assured that anything said in its praise will be amply sustained on trial: Very respectfully yours,

Weston Dynamo-Electric Machine Co.
E. Weston, Secretary.

Electric Light vs. Gas.

In order to settle the disputed question in regard to the economy of electricity compared with gas, the municipal authorities in Paris will, under their direct supervision, have the Avenue de l'Opera, the Place de la Bastile, and one of the market buildings, lit by electric light for one year, at a charge of 6 sous (6 cents) for each burner per hour; while the gas company is to light the Rue du Quartre Septembre, the Place du Chateau d'Eau, and other market buildings by an improved method and superior gas, at a charge of not more than 1 sou (1 cent) per cubic meter.

As a cubic meter is very nearly 10 cubic feet, this is at the rate of $1 per 1,000 cubic feet. Coal is certainly not cheaper in France than it is with us, and our gas companies, who charge $3 on an average per 1,000 cubic feet, must necessarily make enormous profits at that rate. If the electric light excitement does nothing more than reduce the exorbitant price of gas among us, as it already appears to be doing, it will be a blessing.

The Manufacturer and Builder.

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Special Edition to Saw and Planing Mills.

The present number of the Manufacturer and Builder is mailed to eleven thousand saw and planing mill owners in the United States and Canada, before whom we take pleasure in laying it, as the representative of the mechanical industries of this country.

Tampering with the Patent Law.

Most of our readers are aware that there is a movement on foot to induce the United States Congress to make some important changes in our patent law—changes of such a nature that, if passed, they will inflict a most serious blow upon the inventive genius of this country, the progress of which has so greatly been aided by the fostering protection which the law, as it now exists, has extended to it. The proposed changes, while being detrimental to inventors, patentees, and owners of patents, will be highly profitable to such manufacturers, corporations, or any other parties whose interest it is to make use of valuable patents or inventions not patented, at the least possible expense, or without any expense whatever. At the same time it will be a blow against the Patent Office itself, and considerably diminish its income, as many inventors, seeing the increased expense of securing patent rights, and the still more increased uncertainty of maintaining or enforcing the rights when obtained, will not be so ready to apply for patents, being debarred either for want of sufficient means or unwilling to pay more under diminished chances for protection in the ownership of the laborious product of their brains.

The nature of the changes in the patent laws proposed, proves that the proposal comes from: 1st. Parties who thus far have succeeded in secretly infringing various patent rights, and are tired of this secrecy, and at the same time in fear that at any time patentees

may proscute them for damages. 2d. Parties who are dissatisfied because they are prevented from using certain patented inventions, which, if they could use without paying the patentee, would enable them to earn immense profits. We know of several patent rights, which, if they could be annulled or made difficult to enforce by a new law, it could truly be said: "There are millions in them."

In order to justify our unfavorable opinion of the proposed changes, we will mention a few of them, with our comments.

"*Section* 1. No damages can be recovered for infringements that have taken place more than four years before beginning the suit."

The result of such a law would be, that if an infringement escapes the notice of the patentee for four years, the infringer goes free and the patentee gets—*nil*, minus his costs, as a remuneration for the value of his invention.

"*Section* 2. Any one will have a right to use any invention upon paying the patentee a price, the amount of which is to be settled by the courts."

This is downright robbery, as by such a law a patentee would no longer be master over his own invention, and would have to accept a price not agreed to by himself, but fixed by his antagonists. His patent would fall to the level of a description of an invention, which anybody could use without even asking him.

"*Section* 3. If an inventor proves an infringement, and the judgment allows him less than $20, he must pay all the costs of the court, his own as well as those of the defendant—the infringer."

This is practically a threatened heavy fine upon an inventor who dares to sue an infringer, as by sharp law practice the latter may often succeed in obtaining a judgment against himself for less than $20.

"*Section* 4. Infringers have the right to continue their infringement, during any procedure by the patentee, until a verdict is rendered against them."

"*Section* 5. Infringers have the right to remove any injunctions against them, in order to have the privilege to continue infringing."

"*Section* 6. No re-issues shall be granted, unless applied for within seven years from date of patent."

These sections are evidently for the direct benefit of infringers.

"*Section* 7. Inventors cannot base any prosecution for infringement upon a re-issued patent, but only upon the original."

This shuts off the benefit of any correction of a deficient claim by a re-issue, so that in the future re-issues would become worthless, and no inventor would hereafter apply for one.

"*Section* 8. A patent taken out jointly, when only one was the inventor, is void."

"*Section* 10. Infringers may commence suits against patentees to declare their patents void."

This is simply intended to assist infringers to break down patents that stand in their way, and to do it quite easily if the patentee is poor, absent, or dead.

"*Section* 11. If patentees do not commence suits against infringers whom they have warned, within a reasonable time, the infringer may continue the infringement during the entire term of the patent without paying the patentee anything."

"*Section* 12. Besides the $25 to be paid at the issue of the patent, the patentee must pay $50 more in four years, and $100 more in nine years; total, $185 for the price of a patent, as failure to pay any of these sums annuls the claim."

This increased liability of poor patentees would be another cause of diminished applications, and the result would be the same as experienced by a merchant who doubles and trebles his prices while he deteriorates the quality of his goods—namely, a decrease in business. In this case the old advice may be given: "Let well enough alone."

In saying this, we do not mean to convey the idea that we consider our patent laws of the highest perfection, but certainly if the proposed laws were adopted things would be a great deal worse than they are now. The principal evil to be corrected is of a very different nature from that reached by any of the provisions above detailed. It is this:

Frequently a party takes out a patent for an invention, with which he does nothing whatever, debarring others from using it; and if, in ignorance of his claim, some manufacturer uses a process similar to his, and the patentee discovers it and thinks he can prove an infringement, he comes down on the poor manufacturer, bleeds, and often ruins him.

Another evil is that some patentees have such exaggerated ideas of the value of their inventions that they ask exorbitant prices or royalties that no one feels justified in introducing the invention, however good it may be in itself, fearing that it will not pay. For this reason many otherwise valuable inventions have been kept out of use. These cases have been reached better by the patent laws of France. There when an inventor does not prove that he has not neglected to introduce his invention within a certain period, in such a way that the public could reap the benefit of it, his invention becomes public property.

We hope and trust that the good sense of our legislators will prevent them from making changes for the worse in the patent laws, which certainly would be the case if the law at present proposed were adopted, which, while it does not reach the evil, is a glaring injustice to all inventors and patentees.

Freedom of the Press.

Few persons are aware of the intrigues going on among us for curtailing that bulwark of liberty of an enlightened people, the freedom of the press. But it is a fact that certain factions belonging to the clerical and medical professions are making a tool of an institution founded with the best of purposes, and on which thousands of dollars are being spent by scores of well meaning people. They are making the officers of this society, by moral suasion their obedient servants, and as several of them are inclined to fanaticism they continually overstep the mark, and make a society, which originally enjoyed the good will and appreciation of the public, obnoxious in the eyes of all who have common sense enough to see, in its present management, a direct attempt to imitate those countries where the press is not free, and to establish the society as a legal censorship, of matters printed, sold and sent through the mails, submitting the accused to disgraceful imprisonment, and legal prosecution. The society to which we refer is the New York Society for the Suppression of Vice; when first established it did some good, perhaps a great deal of it, and none are more ready to acknowledge the good done than we. But since the society, or rather its agents, have allowed themselves to become the tools of religious bigotry, and medical intolerance, and especially since it has become known that means, other than straightforward ones, are employed; that false representations and promises are made to induce parties to procure books and pictures for them, which may be considered indecent and perhaps often actually are so, and then unexpectedly pounce upon, arrest, bring them to prison, before a court, and obtain occasionally a severe punishment for them; then we say that honest men cannot help despising such means, and also the men who lower themselves to resort to them. It is a surprise, indeed, that their actions have not been denounced by the honest men, who sustain the society with their material support, and pay the salaries of their over-zealous agents, who will finally succeed in defeating the good purposes orginally in view, and necessitate the breaking up of the whole institution, which is threatening to become an inquisition, and has by many already been so called. This is not without reason, as the same treacherous and unfair means are resorted to, by which the inquisition obtained its hold on intended victims.

It only proves that human nature is always the same, and that we have in the 19th century in enlightened America, men of the same stamp as those who, three centuries ago, entrapped Bruno in Italy, and Servetus in Switzerland. We do not speak here of the pretended offence, but of the manner used to entrap the offender. It has been proved that pretended offenders have been actually seduced and entreated by the agents of the company to commit the offence for which they made them suffer, and this principally for the benefit of the chief agent who wants to keep up his business, so as to retain the $4,000 salary paid to him by the society. The strongest proof that these agents over-reach themselves is that for every person accused, and that has been found actually guilty, 10 or 20 innocent persons have been annoyed by arrest, subjected to heavy expenses for defence, and not found guilty. In several cases they have been admitted to bail, and the suit never pressed. For the last five years some 10 or 15 persons have been found guilty, while at least 150 have been needlessly annoyed in the most cruel manner, and some even socially and financially ruined by the interruption to their regular occupations.

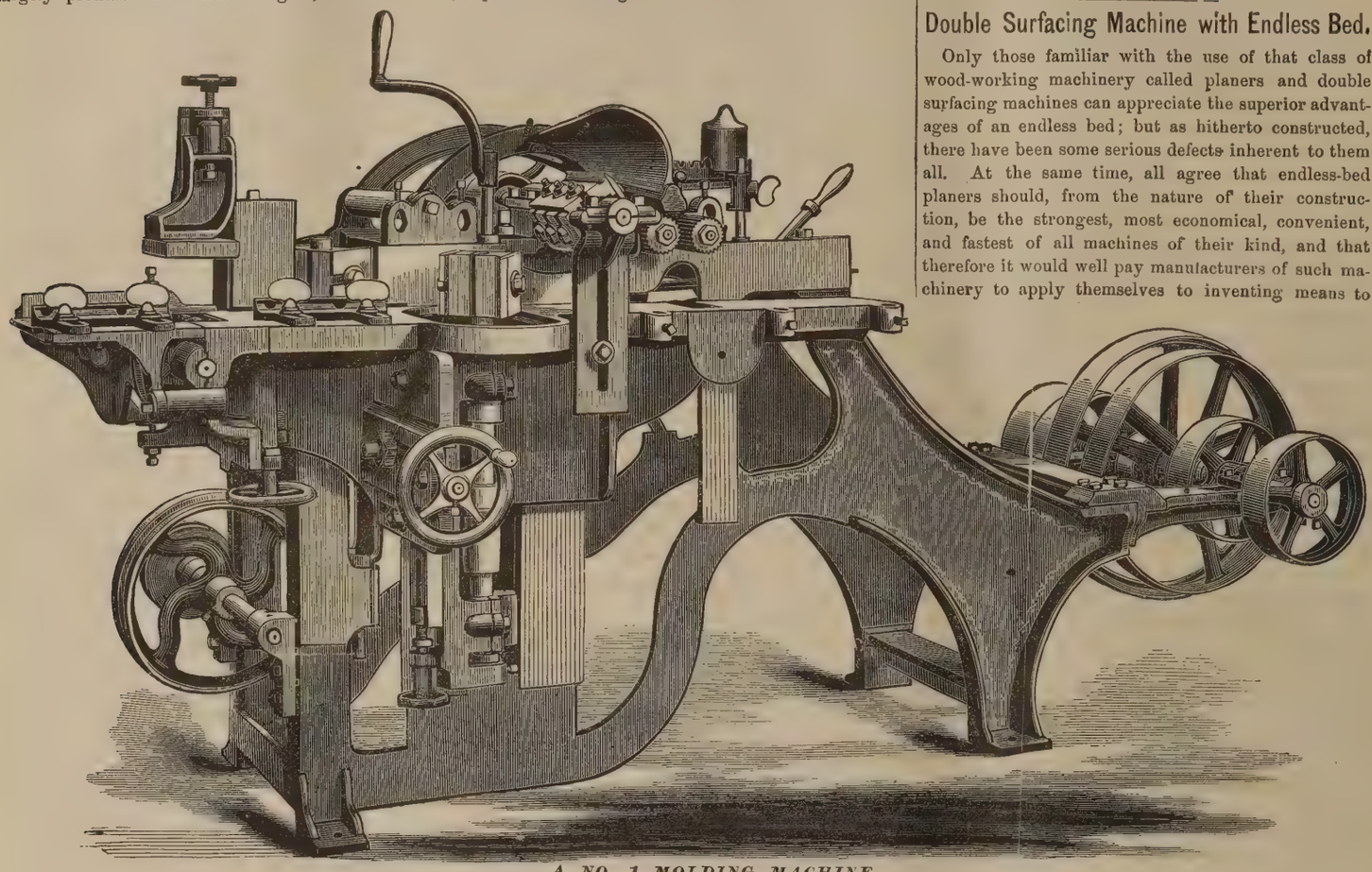
Of the many cases of this kind, we will only mention one in which we became personally interested, Mr. A. Prosch, a manufacturer of magic lanterns, stereopticons, photographic apparatus, etc., whom we have known for 25 years as a hard working, quiet and very able mechanic, and had often employed for making apparatus, came to us in distress. He had been arrested for having procured, at the request of Mr. Britton, the assistant to Mr. A. Comstock, agent of the society, some photographs of statuary, to be exhibited by the magic lantern to a club of young men, assuring Mr. Prosch that he would be well paid for the exhibition, at the same time specially requesting him to procure some racy pictures. Mr. Prosch found what he could, and when ready Mr. Comstock came to see the pictures, and finding one (a photograph of some statuary found in Pompeii or Herculaneum) which he declared indecent, arrested Mr. Prosch, and carried him at once off to prison, where he spent two days and nights. Then he procured bail, and came to us for a certificate of good character. This was freely given, with the addition that he undoubtedly was more sinned against than sinning, and in his simplicity had fallen into a trap set for him.

The case was never called before a court, and is only a specimen of scores of cruel persecutions of this sort. The other kind, that of censorship on printing and selling books and sending them through the mails, has given occasion to many more persecutions; no doubt some of the books have been actually objectionable, but the censorship should be exercised with discretion and knowledge, and not be guided by narrow-mindedness and bigotry. As it is, the officers of the society have not shown much wisdom or liberality, or even common sense, as publishers of medical books have been persecuted as indecent, and the publishers of liberal books as irreligious. We ask what will become of scientific progress, or science and art in general, if the expression and publication of our ideas, and the production of our artists, painters and sculptors, are to be under the censorship of Messrs. Comstock and Britton whose decision will be required to decide whether a book is too liberal in its religious tenets or too free in the explanation of human physiology, whether a statue or picture representing the human form divine, has a sufficient amount of clothes on, to pass their scrutinous examination?

They have already committed the ridiculous and stupid blunder of forbidding the exhibition of a copy of the celebrated Hans Makart picture, representing the entry of Charles V. into Antwerp, upon which, as a work of art at the Paris Exposition, thousands had gazed with admiration. Nor is the only instance in which this absurd want of discrimination has been shown. Several picture dealers of the highest standing have been obliged to take down from their walls pictures on which partly nude figures were represented. If this is not stopped, Mr. Comstock will end in closing all our collections of pictures, and among them the Bryant Gallery at the Historical Society in this city, or at least compel some of the finest paintings to be put out of sight in a dark cellar.

Refinements in Molding Machinery.

Experience having conclusively shown that effort spent in the perfection of labor-saving machinery is largely profitable for those using it, manufacturers have for a long time competed to produce the most perfect and refined combinations to attain the ends proposed in the best and most practical manner. This has lately been especially the case with molding machinery, and the A No. 1 molder of Messrs. Goodell & Waters, cor. 31st and Chestnut streets, Philadelphia, Pa., represented in our first figure, is an illustration of this fact.



A NO. 1 MOLDING MACHINE.

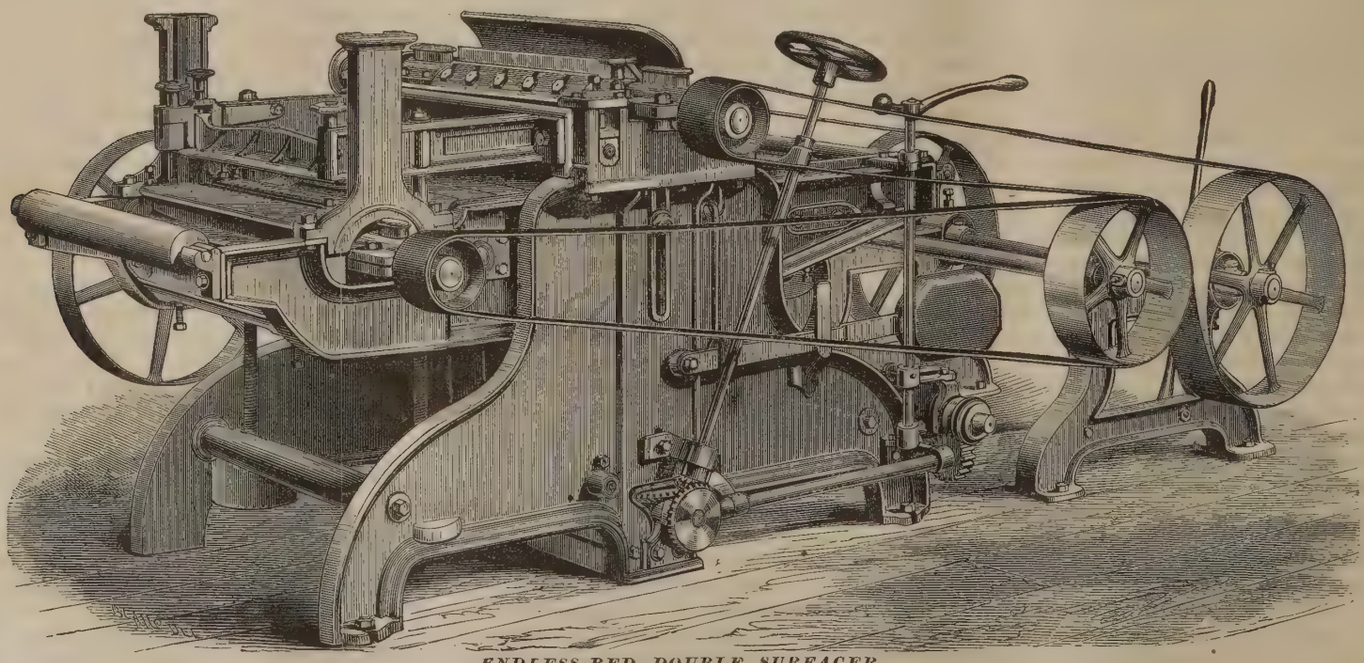
It is a 6-inch four-sided molding machine, of which the top-head has an outside bearing, making it sufficiently strong for any 6-inch molding. The heads are all slotted, while the counter-shaft is extended to give length of belts, thereby lessening the power and strain. A peculiar advantage is that the machine need not be stopped to adjust the outer head, as it can be set at any angle and adjusted to its work while in motion. The inside head is also adjustable, while both heads run on steel spindles of extra size. The bed can be raised and lowered 14 inches by a single screw. This machine is adapted to all kinds of building moldings, sash, door and blind work, and can also make the finest kinds of picture-frame moldings. There are fast and loose pulleys on the counter-shaft, 9 by 4 inches, which should make 700 revolutions per minute. The price of such a machine is about $300.

Further information may be obtained on application to the manufacturers at the address given above.

Double Surfacing Machine with Endless Bed.

Only those familiar with the use of that class of wood-working machinery called planers and double surfacing machines can appreciate the superior advantages of an endless bed; but as hitherto constructed, there have been some serious defects inherent to them all. At the same time, all agree that endless-bed planers should, from the nature of their construction, be the strongest, most economical, convenient, and fastest of all machines of their kind, and that therefore it would well pay manufacturers of such machinery to apply themselves to inventing means to remedy every defect thus far existing, and in this way produce machines possessing all the advantages and none of the defects.

We are pleased to state that this has been accomplished by Messrs. Goodell & Waters, manufacturers of wood-working machinery, cor. 31st and Chestnut sts., Philadelphia, Pa., and a cut of the machine thus perfected is represented on this page. Its cylinders are made entirely of steel, and have long, heavy bear-



ENDLESS-BED DOUBLE SURFACER.

ings, which run in the best Babbit metal boxes. The upper cylinder, pressure-bar, and pressure feed-rolls are all mounted in one heavy casting, which is firmly bolted to the sides of the machine. The boxes of the lower cylinder are also tied together by means of a heavy yoke, and the cylinder can be raised or lowered without the possibility of twisting or binding the boxes. The bed is lowered or raised either by hand or power; the power arrangement is very simple and easily worked; it consists of a worm and gear; the worm is right and left, and is fixed on the end of a feed-shaft and allowed to work endwise on a spline, so that the operator can throw the right or left hand worm into gear at will, moving the bed up or down at pleasure. Both the hand-wheel for the hand movement and the lever for the power movement are conveniently arranged, as they are above the bed of the machine and near the scale for indicating the thickness of lumber, which can be seen on the engraving. This machine will plane 10 inches thick and 26 inches wide.

The plats of the travelling-bed are very heavy, and are connected by means of the butt-hinge joint, the center of which is under the center or opening between the plats. This carries the plats away from the lumber as it turns down over the carrying-wheel at the end of the bed, and cannot raise or even press against the under side of the lumber so as to interfere with the work of the lower cylinder. When this style of joint is used, there are only one-half the number of joints in the whole bed that are used with the wrought-iron links.

There are four self-oiling ways on which the bed travels, two at the extreme ends of the plats and two in the middle. The combined width of the four ways is 12 inches, and they are not liable to wear or get out of order. The lower cylinder can be got at to adjust or sharpen the cutters by simply lifting out the front roll, one piece of the adjustable bed, and turning back the pressure-bar. The whole can be done in less than half a minute, and the cylinder is as handy to get at as would be on a bench.

The weight of this machine is 5,000 pounds, and its cost $800, complete, which however, considering the large amount of work it will turn out, and the equally large amount of labor it saves, is in the end very cheap.

Commercial Nickel.—Commercial nickel varies much in quality. Some samples are mere alloys of copper and nickel. All the "nickel coins" are really nickel alloys, containing a large proportion of copper, generally two-thirds of the whole weight. Copper is not objectionable in nickel to be used for the manufacture of German silver, but the presence of more than traces of iron, sulphur, lead, and antimony must be avoided.

Improved Gang-Edgers.

Among the machines which have been evolved by modern progress in the production of contrivances for special purposes, are what are called "gang-edgers." They are intended to split wide boards, square their edges, rip scantling, car sills, and other framing timber from cants, and this with great economy of power and time, in comparison with the ordinary methods, as done with large mills. They consist of a power-feed with a movable bed carrying the stuff under a revolving shaft, provided with a number of adjustable revolving saws, and adjustable fences. The machines of this kind thus far made had defects, which have been overcome in the one represented in our engraving, and which is giving great satisfaction, judging from the very flattering testimonials which have fallen under our notice.

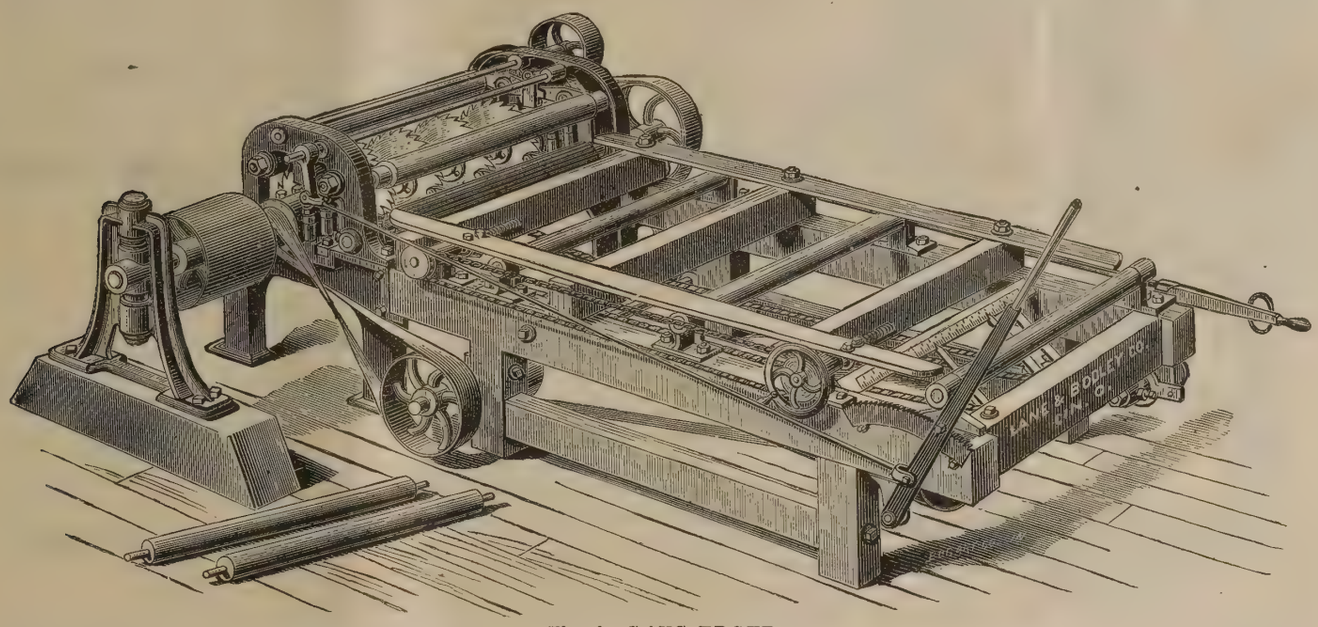


Fig. 1.—GANG-EDGER.

The main frame is of cast-iron, of simple design, and of great strength. The mandrel is $2^{15}/_{16}$ inches in diameter, and has three patent self-lubricating bearings, one of which is on a pedestal at the outside of the main pulley. A feather is secured to the mandrel for the pulley and the saw collars. The saws are from three to six in number, and fitted with means for adjusting their position when in motion.

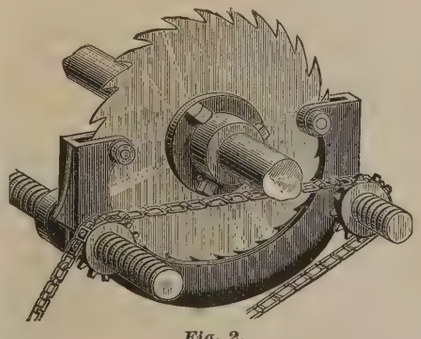


Fig. 2.

The radical improvement is in the method of holding and moving the saws. All other devices thus far invented take hold of the saw collars in a groove. The result is much wear, while the unguided saw follows the grain of the timber as it may lead, to the extent at least of the last motion of this collar, and all links and joints to the confining notch, so that the products of such machines are very irregular in thickness, and no carpenter expects to get his framing timber within one-fourth of an inch of a uniform size—so universal has become the admission of the imperfections of gang-edger sawed stuff. This slack control of the saw makes a very heavy saw-plate a necessity, and it frequently happens that the mandrel is sprung, the saw spoiled, or the machine stopped, by the "running" of the saw from a true line. It has been the aim of the inventors to remedy this difficulty and also to supply a machine to run with a thinner saw and less power, and to make accurate lumber, so that the machine will be satisfactory to box makers.

Fig. 2 illustrates how this has been accomplished. The grooved collar and forks are abandoned, while the saw is held between two pairs of fingers, or guides, at opposite sides of the saw, just as a man would take hold of the plate to slide it, were the saw not in motion. Thus the rim is guided, and the saw restricted at its cutting edge to the *set* line, and opportunity is given the center to right itself, if by heat it should expand and buckle.

The two guides have adjusting screws, and are at opposite ends of a yoke. Each end of the yoke carries a nut with sprocket teeth on the end flange. These nuts are supported at each end by coarse pitch screws, lying parallel with mandrel across the frame. A chain passes over the sprocket wheels on the nuts, to similar nuts and screws at the front of the receiving table, where a constantly rotating shaft, driven by a belt from the feed counter-shaft, communicates motion through the chain and nuts to either saw, and moves them in either direction, as either pulley of a friction reversing gear is engaged with the rotating-shaft. Clutches are provided for throwing into gear either one of the chain-nuts, so that adjustment of one saw may take place without disturbing another.

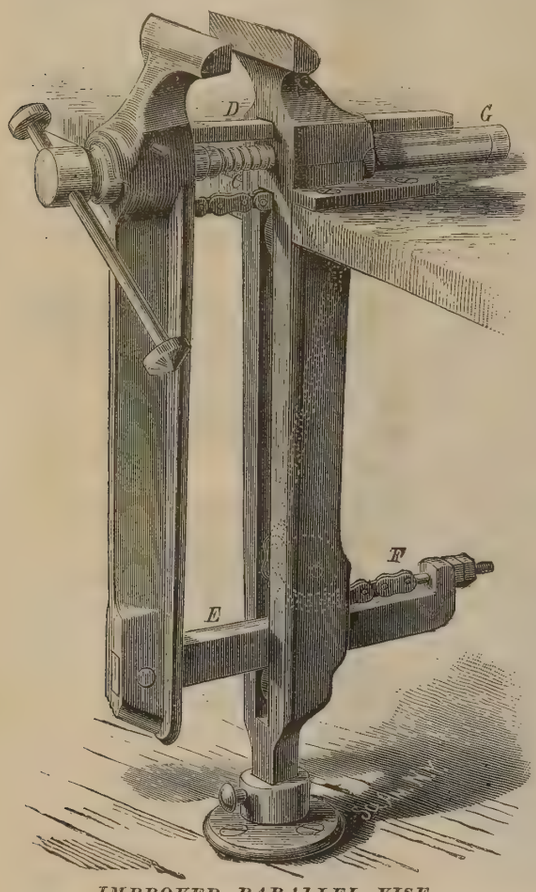
The lower feed-rolls are driven by a pulley on end of each, and a single belt. A tightener is provided, under the control of the sawyer, for putting additional strain on the belt, as may be needed.

The upper rolls are carried in the ends of four short levers, pivoted near their center, and are raised by a link fastened to the free end of each pair, and connected by a rocking-shaft, cranks and rods, to the sawyer's stand.

The sawyer raises the rolls to receive stuff of greater thickness than the preceding piece, but the weight of the rolls gives sufficient resistance to the feed of the lower rolls, to carry through rapidly four-inch stuff, with all the saws cutting. The shaft of the stationary binding pulley on the feed-belt forms a brace for the top of the frame, and also a return-roller for assisting the return of boards, requiring a second passage through the machine. The front table is furnished with the machine. It has iron rollers, one stationary fence, and on the opposite side of table an adjustable one. This has a parallel movement by a screw at each end, connected by a chain, so that the sawyer can adjust it without leaving his place. These machines are manufactured by the Lane & Bodley Company, Cincinnati, Ohio, to whom we refer for details, prices, etc.

Improved Parallel Vise.

The old fashioned vise, hinged below, is a regular nuisance, as it never holds the objects firmly, the jaws being most always at an angle, rarely fitting the piece to be worked at. Nowadays no good workman will have anything to do with such a vise, but wants a parallel vise, made in such a way that the movable jaw is not hinged, but remains parallel with itself while moving. Several systems have been invented to obtain this parallel motion, among which the one represented in the adjoined engraving deserves special notice, on account of the ingenious device by which, while the parallelism is obtained, the holding power is also increased.



IMPROVED PARALLEL VISE.

The jaws A B, which are of the long pattern, are drawn together by the screw C, and guided by the bars D E, which are fixed in the jaw B and pass through mortises in the jaw A. A chain F is attached to the jaw B just below the screw, and passes over a pulley in the upper part of a slot in the jaw A, and under a pulley in the lower end of the same slot, and is provided with a threaded rod which passes through an ear formed on the end of the bar E. By means of this rod the chain is adjusted. The lower bar E rests upon a roller journalled in the lower end of the slot in the jaw A. The box G, which contains an internal thread for receiving the screw C, has a flange which drops into a socket in the back of the jaw A, and is prevented from turning by the bar D.

It is evident that the moment the vise begins its grip on the object, the latter makes a fulcrum, the screw being the power and the resistance below; the movable bar becomes a lever of the third class, which transmits the effect exerted below by the chain to the point where the power is applied, and aids the screw by pulling in the same direction; while, by loosening the screw, the reverse takes place, and the object is sooner and more easily relieved, as it is obvious that when the jaws are opened the chain F will cause the lower end of the jaw B to move as rapidly as its upper end. It is therefore claimed by the manufacturers that this construction not only secures the parallelism of the jaws, but that it also renders them very effective.

This vise was recently patented by Mr. J. K. B. Solomon, and is manufactured by Messrs. Taylor & Corser, of Riegelsville, Warren Co., N. J. It is made in various styles and sizes, of which the prices vary from $10 to $28.

We call the attention of all workmen who appreciate a good vise to the above described style. They will agree with us that no tool is more useful, but at the same time more abused than the vise, and it is on account of this abuse that this tool is so frequently found to be not in really good order. This, however, is often caused by a defective principle on which they are made, and often from defective material, the jaws not being hard enough; but very often it is the fault of those using the vise. We find, however, that a handsome tool, like the above, commands respect, and that workmen are not so apt to abuse it as a tool which is so defective as to disgust and often exasperate them.

The larger kinds of these vises are intended especially to fill the wants of ship, locomotive, car, and bridge builders, and others who execute heavy work. The smaller kinds are intended for pattern-makers, cabinet-makers, wheelwrights, and carriage builders. They were on exhibition at the last fair of the American Institute in this city, where they were subjected to severe tests in regard to their strength and power, and the result was the award of the highest prize—a medal of superiority.

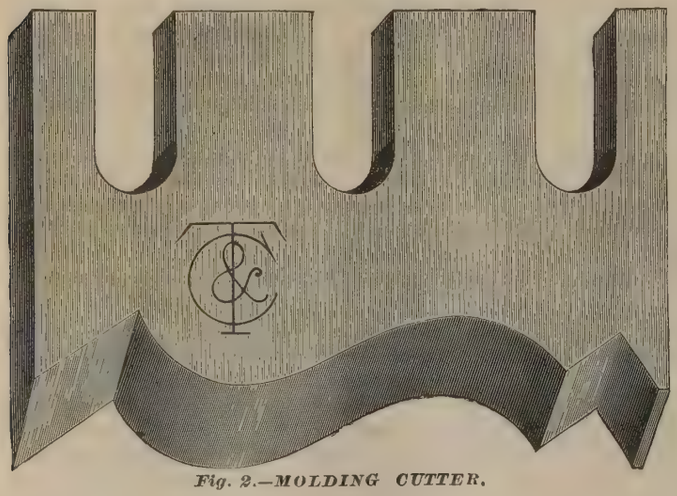


Fig. 2.—MOLDING CUTTER.

Knives for Machines.

The great number and variety of cutting machines generally introduced in the United States within the past few years have originated a special branch of manufacture for making special knives adapted to the different machines in use. These are planing knives, molding knives, knives for panel-raising, tenoning, tonguing and grooving, jointing, etc., also cope cutters, fodder cutters, sash and door cutters, German siding knives, spoke lathe knives, and others for wheel-making machinery, etc.

Among the manufacturers of these articles, Messrs. Taylor & Corser, whose works are located at Riegelsville, Warren Co., N. J., have earned an enviable reputation, while every year they have been increasing and improving their facilities, and adding to the number of their customers. Besides making all the varieties of knives mentioned above for wood-working, they also make those used by paper-makers for cutting and trimming paper, knives for book-binders, paper-box makers, and for leather-splitting machines.

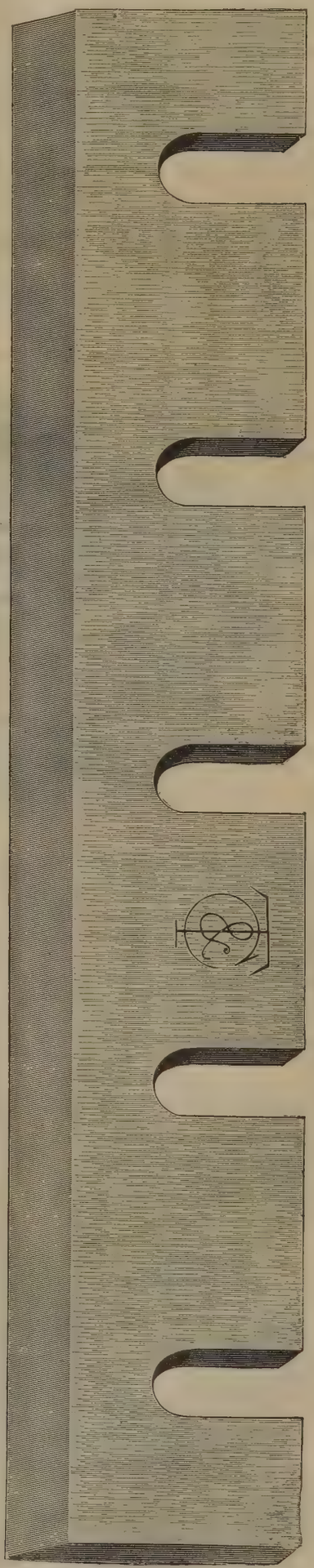


Fig. 1.—PLANING CUTTER.

They also make a specialty of the manufacture of large and difficult knife-work, such as veneer knives, cheese-box rim knives, barrel-heading knives, shingle knives, knives for chipping dye woods and wood for paper pulp, and finally shear blades for cutting iron, copper, and other metals.

This firm during the past year have added some new articles to their manufactures, among which ought to be mentioned an improved machine for cutting all kinds of paper stock. In Figs. 1 and 2 we represent

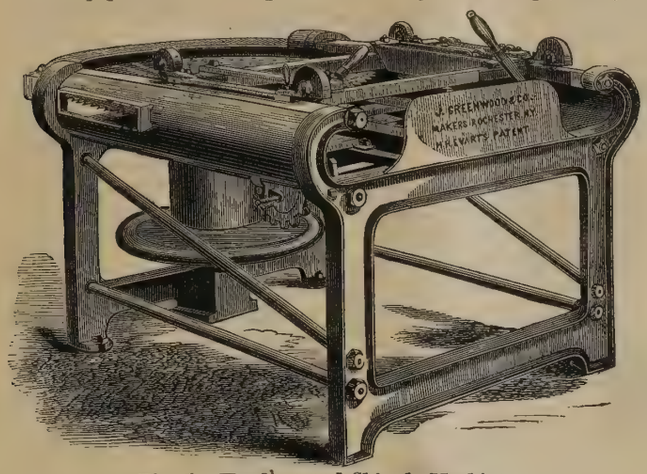


Fig. 1.—Heading and Shingle Machine.

two knives, Fig. 1 being a planing, and Fig. 2 a molding cutter, both in their natural size.

If any one should ask what the cause of the success of such manufacturing establishments as the one we now speak of is, we answer, the unvarying rule adopted to use nothing but the best and most suitable material that can be obtained for the purpose intended, and the superior workmanship by which this material is adapted to the wants of those who are to use it.

Machinery for Barrel-Making.

Barrel-making by machinery is becoming one of the established industries of the United States, and this is not surprising, as there is perhaps no other country where there are so many staples produced which require barrels for their storage and transportation. Our flour, our sugar, and especially our petroleum require barrels by the million, not to speak of apples, potatoes, and other products of the farm, which are immensely transported in barrels. This immense demand has rendered it impossible for the manufacturers of hand-made barrels to supply the wants of consumers, and hence the necessity of the invention of barrel-making machinery to quicken the labor and at the same time cheapen the price, and it will not be long hence that barrel-making by hand will be as obsolete and exceptional as weaving by hand is at the present day.

The creation of a new branch of industry has been the result as a necessary consequence of this changed condition of things, namely, the establishment of manufactories for the making of barrel machinery. Of these the foremost and oldest is that of John Greenwood & Co., of Rochester, N. Y., who, previous to 1871, only made slack-barrel machinery; but at that time the business increased to such an extent that they were induced to erect a five-story brick building 116 × 40 feet, obtaining their power from the falls of the Genesee river. By the way, it may be interesting to many readers to be informed that the machinery of these works is driven by a wire cable only ¼ an inch thick, running at a high velocity 50 feet above the ground, and conveying the power to a distance of 200 feet. It has run 6 years and is good for 5 years more.

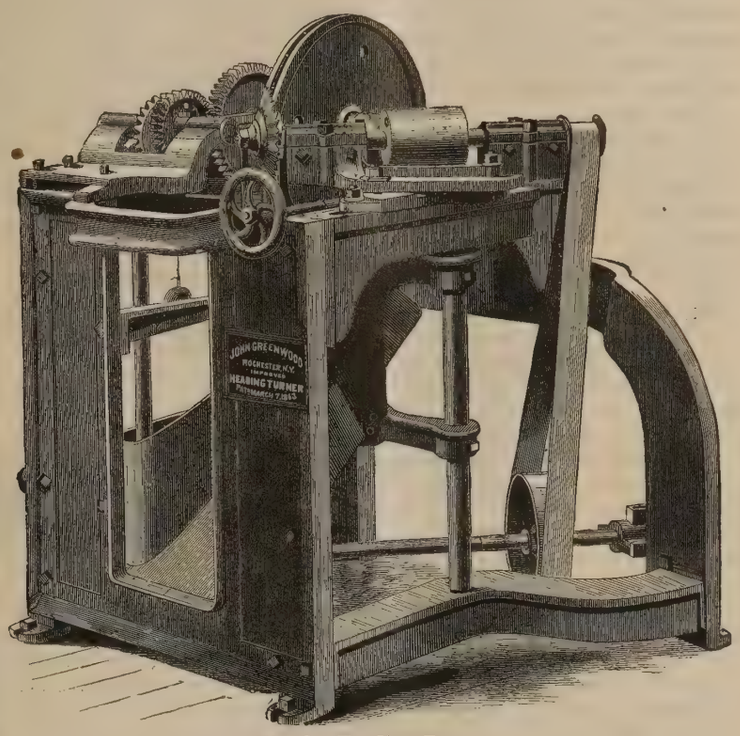


Fig. 2.—Heading Turner.

The manufacturers now also make tight-barrel machinery, for which they claim great superiority. We illustrate on this page some of the principal machines, with their latest improvements, used in barrel-making.

Fig. 1 is a heading and shingle machine, which has been thoroughly remodelled and made much stronger than this class of machines have usually been built. There is perhaps not one individual that has used this class of machines but what has experienced more or less danger or expense by the frail manner in which they have been constructed. Serious accidents have occurred to persons and machines that would not have happened had the machines been built in a proper manner, or with regard to the work they had to do. The manufacturers have added to this machine from 300 to 400 lbs. more weight, besides improving the shape of the patterns, so as to give the greatest strength in a given amount of material; a new self-acting arrangement for shingles has also been added, that is at once simple, effective, durable, and superior to anything before used. About 100 of these machines have been sold, and they are giving satisfaction; parties using them speak in the most flattering terms, claiming that they are the best machines for either heading or shingles, or both. As a combined machine, or for tight-barrel heading and box stuff, the machine is easy to operate, holding the bolt very firmly, so that there is no slipping; no danger of the operator getting hurt with the saw; it saws very close up to the slab, and makes no thin heading. The belts run as well and last as long as any other belts, and the machine takes

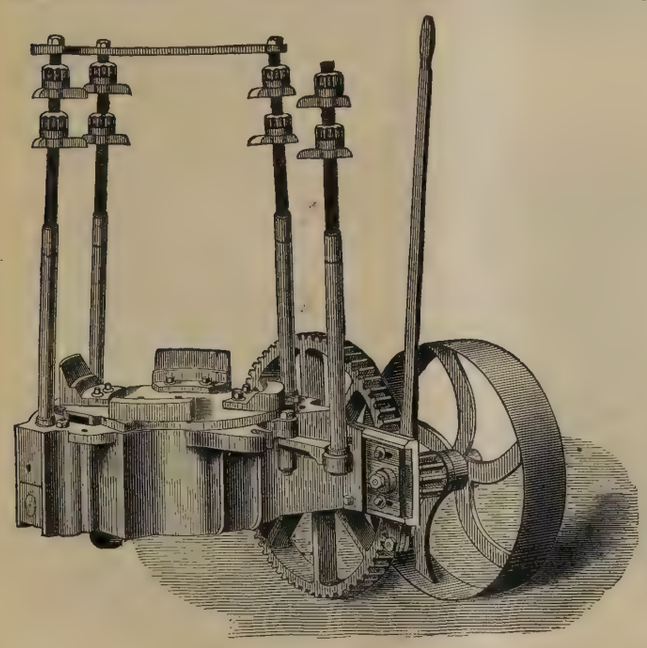


Fig. 3.—Trussing Machine.

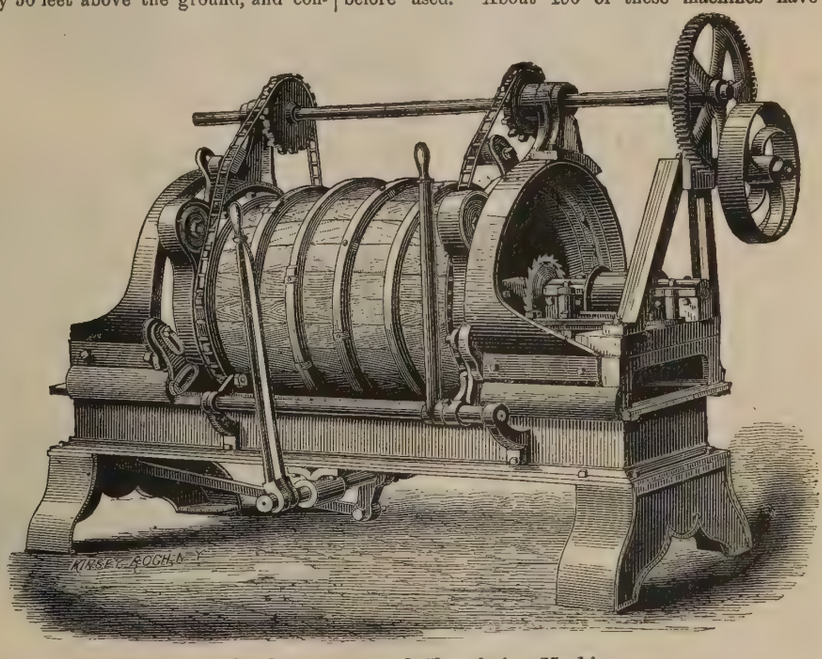


Fig. 4.—Crozing and Chamfering Machine.

as little power as any doing the same amount of sawing. The saw can be taken off and another put on in three minutes, thus avoiding the loss of time in stopping the machine while the saw is being filed. The machine will take a bolt 16 inches wide and from 12 to 26 inches long; the largest ones take a bolt 32 inches long, and are designed for sawing 30-inch shingles, much used in the South, where several of these machines are running.

Fig. 2 represents a heading turner; it is designed for circling all kinds of headings, from 10 to 18 inches in diameter. They can be made so as to make keg heads as small as 5½ inches. The machine is almost automatic in its operations. Aside from putting the heading in between the clamps, all the operator has to do is to tread on a foot lever; by this one lever the head is very firmly clamped, the clamps swing up to the saw, and the machine put in motion. When the head is finished, the machine throws itself out of gear, discharges the head, and is in position to receive another. The operator, having no need to touch the machine with his hands, can have a head ready to drop into the machine the moment the finished one is discharged. By this arrangement a great saving of time is effected. Some of these machines now running are turning out 5,000 heads per day of 10 hours. These machines are fitted with spring clamp when required for uneven heading. The saw arbor is of cast-steel, the pulley is placed between the journals, and the boxes are self-oiling, which are connected together in one casting, and do not swing on a center, as in some heading turners, but are bolted firmly to the main frame of the machine. The pressure of clamping the head is resisted by cast-steel steps and points hardened, having the points of bearing at the center of the shafts, which reduces the friction caused by the pressure to the least possible amount. The machine is fed from the saw arbor above, so that in case anything happens to retard or stop the saw, the feed will be retarded or stopped also, and prevent the saw being broken or injured. There are over 600 of these heading turners in operation in the United States, Canada, Cuba, Spain, Prussia, and Australia. The weight is 820 pounds; weight of counter-shaft, 225 pounds; speed of saw, 5,000 revolutions per minute; power required, 4-horse.

Fig. 3 represents a trussing machine, used for forcing the truss hoops on the barrels after they have been heated. The barrel is placed on its end on the platform of the machine, the cam shaft is then set in motion by the hand lever, the barrel is forced upward, and the hooks hold the hoops stationary while the barrel is forced into them until they are tight enough without crippling the barrel. It is impossible to make the bilge of barrels all alike, and a machine that has a positive action will not work well. This one can be governed so that no hoop is driven too much or too little. The head hoop is driven from the bottom, while the two are driven at the top; the barrel is then turned over and the operation repeated. When the gears are disengaged, the platform returns to its original position. The capacity is 1,000 to 1,500 barrels per day, and the weight 800 pounds.

Fig. 4 represents a crozing and chamfering machine. When the trussing is completed, the barrel is put into the centering rings of this machine, which hold it firmly while being operated on by the crozing and chamfering tools. The centering rings are driven by chains, and the driving shaft at the top of the machine forms the center on which the rings and the barrel swing to and from the cutters. The arrangement allows the arbor-boxes to be bolted permanently to the pedestals, dispensing with slides, joints, and ring gearing, which are constantly liable to clog with oil, dirt, and chips. The average daily capacity is 1,500 for slack and 800 for tight barrels; speed of arbors, 5,000; weight, 1,500 pounds.

We earnestly advise all barrel-makers and coopers who possibly can afford it, to lessen their labor by procuring some such machinery, and for further information address John Greenwood & Company, Rochester, N. Y.

Improved Carpenters' Tools.

It is sometimes charged against the mechanics of to-day, that in no branch do they "learn a trade," as in other times. This is undoubtedly true, so far as the learning by a regular apprenticeship is concerned. In some degree this matter has been influenced by the introduction of machinery into many of the trades, where hand work was formerly exclusively employed. In some of the trades, notably among wood-workers, great improvements have been made in the tools employed by the men, and this must have contributed somewhat to the increased facility with which a trade may be "picked up" by young men with a correct eye and a steady hand.

We illustrate on this page some of the novel tools, more recently introduced, by which less skill in the workman is perhaps required than formerly for the prosecution of the difficult kinds of work for which they are adapted.

Fig. 1 represents what is called a "Bull-nose" rabbet plane, the cutter being set at the point of the stock, thus making it possible for the workman to plane close up into corners where an ordinary plane could not be used. By means of the screw on the top of the plane, the parts can be adjusted so as to open or close the throat of the plane as it may be convenient.

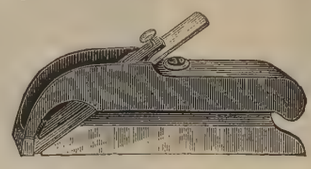


Fig. 1.

Fig. 2 illustrates a circular plane, having a flexible steel face. By turning the knob on the front of the plane, the face can be accurately adjusted to any desired arc, either concave or convex, and a circular surface can be planed with the same ease that a flat surface can be by any other plane.

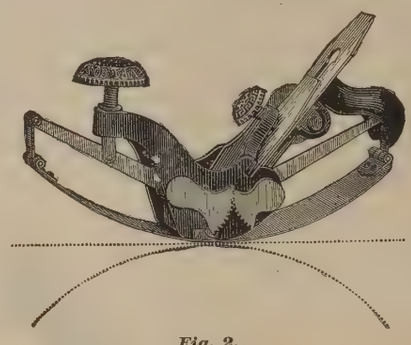


Fig. 2.

Fig. 3 represents a tool of another class, but largely used now. It is a miter-box, adjustable to any angle, and it can be used with a back saw, or with an ordinary panel saw, as the worker may wish.

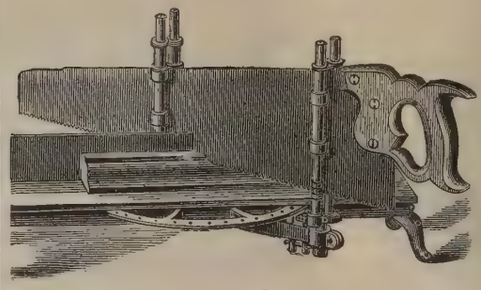


Fig. 3.

The foregoing tools are selected from a large assortment of improved carpenters' tools manufactured by the Stanley Rule and Level Co., of New Britain, Conn. They publish illustrated circulars of tools, which are freely sent to mechanics who make application by mail. The goods themselves are found in all hardware stores.

Building Intelligence.

In this city, Mr. Geo. B. Post, architect, is about to prepare plans for the residence of Cornelius Vanderbilt, for which a site was recently purchased on the corner of Fifth avenue and 57th street. Details are not yet decided upon, but expectations are that as a residence it will take rank among the most palatial.

Phelps, Dodge & Co., have torn down about one-half of their warehouse in Cliff street, this city, and are to erect a building on its site, to be known as the "Phelps Building." It will be very complete in every part, with steam elevators, heating apparatus, etc., and will have an ornamental front of brick and stone, with arched windows.

One of the finest improvements that is contemplated in this city, will be the extensive structure for office purposes, on lots Nos. 14, 16 and 18 Wall street, with a rear extension forming an L at No. 3 Nassau street. The owner is Mr. Frederick Stevens, and the architect Mr. G. E. Harney. The building will be thoroughly fire-proof, brick and iron being employed, with no combustible material in any part.

Ornamental Glass—Stained and Embossed.

Among those who have made this manufacture a specialty, is John H. Gratacap, of 175th street, east of Third avenue, New York, who works chiefly the emery process, which, considering the comparative fineness of flow of emery and sand, produces a very fine grain, while the coarser sand produces only a multitude of scratches.

In order to compete in price with the coarse sand, he also makes an obscured glass by the vapors of hydrofluoric acid, which, however, he does not recommend for plate glass. After it is first ground with emery, the liquid hydrofluoric acid may be used to etch on the glass, and restore its transparency at the place etched; and if the process is continued for some time, it will cause the obscured letters to have the appearance of being embossed on a background of transparent glass. If the glass is flashed on its surface with a coloring material, the same acid may be used to remove the colored surface layer, and thus make white letters on a colored background, or *vice versa*. It is evident that there is no limit to this style of ornamentation; any design can in this way be reproduced, from the simplest scroll or lettering to an engraving cut upon it, as fine as if made by the artist himself. An experience of nine years has enabled this manufacturer to understand all processes, and he claims to produce at the lowest prices the best kind of work, suitable for glass in doors, partitions, desks, cars, steamboats, etc.

Expert Help for Inventors and Manufacturers.

A scientific expert office has lately been established at 37 Park Row, this city, by Mr. Park Benjamin, who has secured the services of experts in engineering, mechanics, metallurgy, chemistry, and other branches of science, and proposes to furnish expert aid of all kinds to those needing the same at reasonable prices. Almost every inventor and manufacturer requires descriptive circulars of his inventions or products. Facilities are provided not only for the printing and illustration of these but also for writing them in the best manner for attracting public notice. Mechanics and inventors can apply to the office for recipes and information, which are furnished promptly, while a specialty is made of testing machinery, making chemical and metallurgical analyses, providing expert testimony in lawsuits, selecting and purchasing new and second-hand tools and machinery, preparing articles for publication in scientific journals, procuring books for mechanics, and giving advice as to the best books to study by those desiring to educate themselves in any branch of science. He proposes to furnish manufacturers and inventors such information as they may want, or help them in what they wish to accomplish—except in the selling of patent rights, in which work the office does not engage.

An Improved Feed-Water Heater.

No engineer who has thoroughly studied his profession, can any longer doubt the advantage of resorting to means to utilize the heat of exhaust steam for heating the feed-water, even in condensing engines. The only question is how to utilize this heat in the latter case, as it has of course to be done in its passage from the engine to the condenser. The practical difficulty connected with this great problem has been solved in the ingenious Berryman system of ∩ shaped tubes, which are placed in a cylinder through which the feed-water passes, and also through which the exhaust freely circulates in its passage from the engine to the condenser, without giving rise to any back pressure. The complete arrangement is represented in the adjoined engraving, where the feed-water heater is seen at the right side, receiving the cold water below and discharging it a heated condition at the top, while the exhaust steam enters at one side below, passes first upward and then downward through the system of ∩ shaped tubing, and escapes again below at the other side, the bottom part of the heater being divided by a partition. The steam then escapes to the condenser, and from there to the air-pump and hot well, from which the feed-pump can take the water, and send it through the heater described, to be further heated.

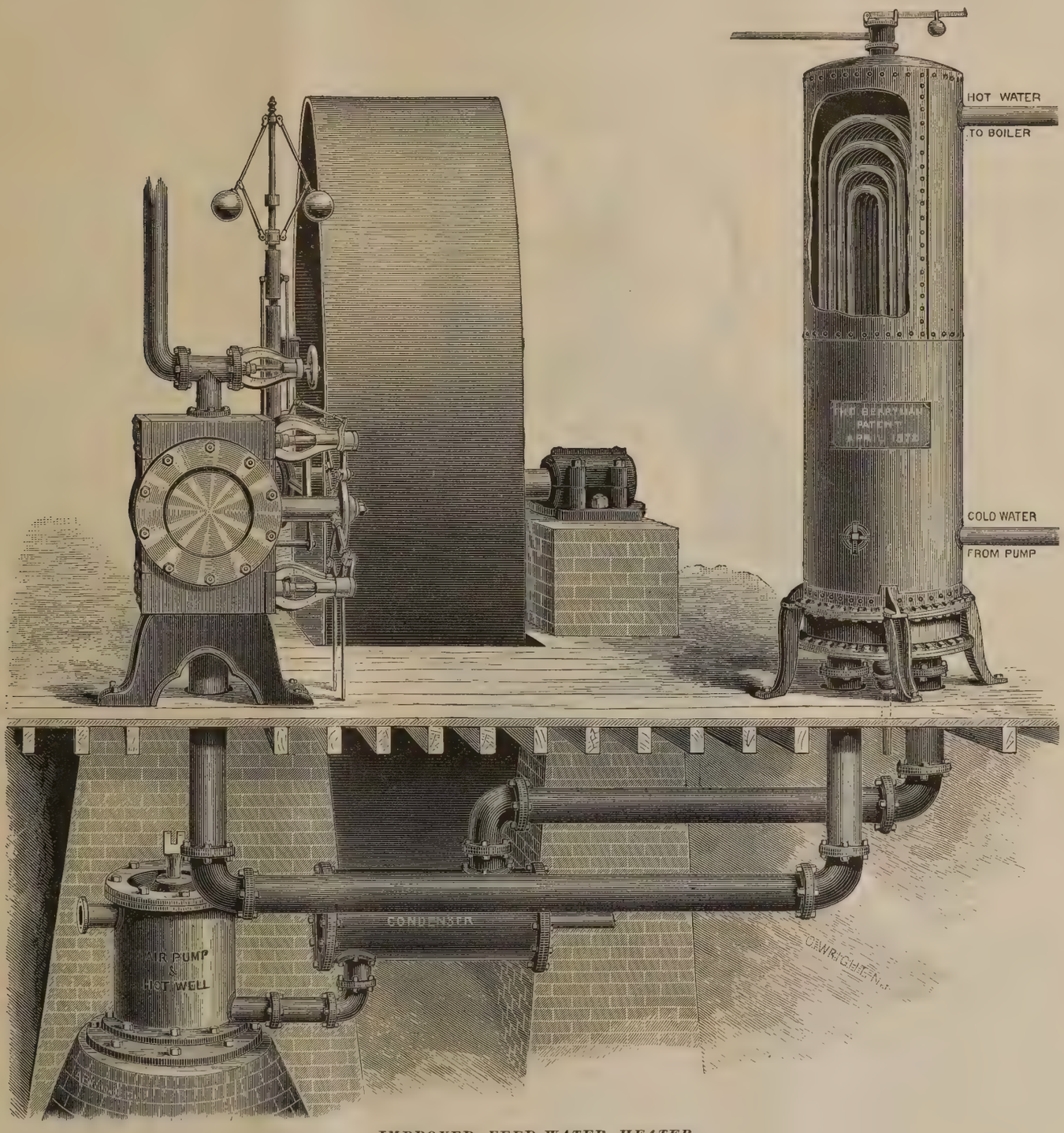
It is evident that while for a high-pressure engine the water may thus be heated to nearly the boiling point, say 210° Fah., for a low-pressure engine it cannot be heated to such a degree; but this will be gained, that while in the hot well the temperature of the water will not exceed say 100°, this water, when pumped into the boiler, will arrive there at say 85° or 90°, while when passing through this heater, after leaving the pump, it will enter the boiler at a temperature of 150°, or more, a gain of 60°, or 60 units of heat for every pound of water passed; so that on the basis of evaporating 50 pounds of water per horse-power per hour, for every horse-power 3,000 units of heat are economized per hour, a saving of at least ¼ pound of coal per horse-power an hour.

Now, this may appear a trifle at first sight, but if we consider an engine of 60 horse-power, it is 15 pounds of coal per hour, or 150 for a day of 10 hours—an amount by no means to be despised at a time when the economy of coal for the generation of steam-power has become one of the most important problems of the age.

Another great advantage is that this arrangement is an actual surface condenser, but of such a nature that for the condensing water salt water may be used, and the boiler fed with cold water, which will be heated by the steam on the same principle as the surface condenser.

An incidental advantage must not be overlooked, namely, that it acts as a purifier, as it is well known that if water is heated before entering the boiler it will form deposits, and greatly diminish the tendency to incrustation in the boiler.

The Berryman heater is manufactured by I. B. Davis, of Hartford, Conn., of whom all further information may be obtained.



IMPROVED FEED-WATER HEATER.

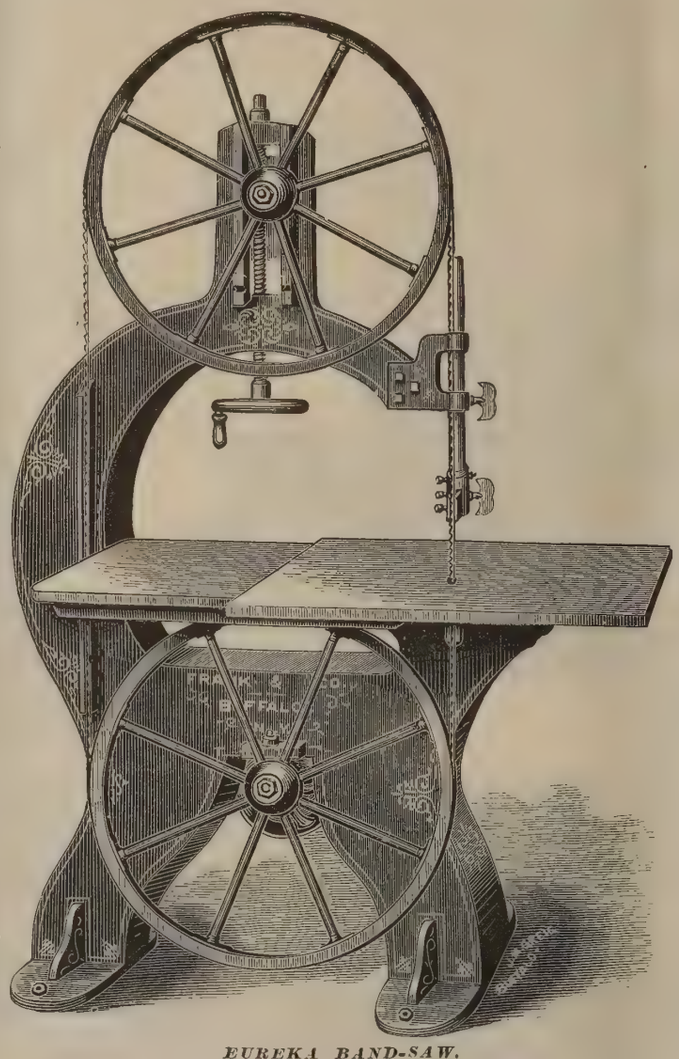
The Eureka Band-Saw.

It is evident from the nature of the machine that a band-saw must be far superior to all other contrivances invented for scroll-sawing, and this for several reasons: 1st. It must saw at least three times as rapidly as the ordinary up-and-down moving saw, as at least two-thirds of the time is lost—one-third during the upward motion when the saw does not cut, and at least one-third for stoppages at the beginning and end of the stroke. This includes the retardation of the saw before and after these periods, as such a saw has only the full velocity at the middle part of the stroke, a velocity steadily and continually possessed by the band-saw. 2d. It always takes less power to drive a machine working with all its parts in the same direction than one in which, by oscillating parts, inertia has to be overcome by the continual stopping and reversing of the motion of the moving parts. Hence a band-saw, while it performs in the same time three times the amount of work that a common scroll-saw can accomplish, does not require three times the amount of power to drive it. 3d. It is extremely fatiguing for the workman, in using the common scroll-saw, to be obliged to continually hold the work down on the table to prevent it being displaced by the rising stroke, while in the band-saw it will naturally be kept in place, the saw cut keeping it down, which at the same time makes it easier to follow the lines of the pattern. 4th. The capacity of a band-saw is, by the nature of its construction, greater in regard to the size as well as to the amount which can be finished in a given time. 5th. The cut of a continuous moving saw is naturally more even and smooth than the cut of a saw which is continually jerking up and down, hence it must produce better work. We have only to add that the experience of all who have used the ordinary scroll-saw and the band-saw have fully confirmed the reality of the advantages above suggested.

Considering all these important advantages, it may be asked why band-saws were not before generally introduced, as they were invented and patented in England in 1808. The answer is simply because the blades formerly made were either very inferior, or they were of so high a price, as were also the machines, as to make manufacturers reluctant to buy them. It required a second invention to render them a success, namely, the invention of the art to make blades of such even temper that they would stand the continual bending over the pulleys without frequent breaking, and to make these blades at such a low price as to bring their use within the limits of the majority of manufacturers who use such saws.

Good blades have been made for many years, but it has only been within the last four years that Frank & Company, manufacturers of wood-working machinery, 176 Terrace street, Buffalo, N. Y., have commenced making band-saws. They started the business by placing in the market two sizes of machines, at a price 50 per cent below those of any other saws of the same kind, while they claim that any other band-saw in the market not their make, is, if sold at the same price, far inferior. They call this superior style the "Eureka" band-saw, and it is represented in the adjoined engraving. It possesses the important advantage of being simpler and consisting of fewer parts than any other machine of the same kind. It contains only half the number of pieces; the frame is cast in one piece, and is very strong and substantial. The device for raising and lowering the upper wheel and adjusting it to make the saw run in the proper place on the wheels is the simplest that is possible. It is adjusted by simply turning a thumb-screw without having to tighten or loosen any screws or bolts. The upper wheel runs loose on the spindle; this and the loose pulley have C. Purdy's patent self-oiling device for loose pulleys, which will hold oil enough to oil it for one month or more. The screw which raises and lowers the upper wheel rests on a rubber spring, to compensate for the expansion and contraction of the saw. The lower spindle which carries the lower wheel, can also be easily adjusted to change the run of the saw.

This firm build three sizes of these machine, varying in price from $60 to $125; the larger have wheels with wooden rims and wrought-iron spokes; the two smaller ones have iron wheels. They also manufacture a combined band and scroll sawing machine, which is very convenient for those who have work with both machines, as it saves the room of one machine. For further information inquire of the manufacturers.



EUREKA BAND-SAW.

Material for Serious Fires in New York.

The New York *Sun* reports that the Fire Commissioners have taken action (not a day too soon) in the matter of landing crude petroleum upon the piers of this city. Hereafter no vessel carrying that dangerous cargo is to be allowed to approach within two hundred yards of the river front until the department has been duly notified, or to land the petroleum without a written permit, or to remain within two hundred yards of any pier, bulkhead, or slip after sunset; and permits will be granted only to vessels so constructed that the oil, if it ignites, will not stream overboard to set fire to neighboring vessels or pier sheds. These rules, strictly enforced, will lessen a great danger to which New York is exposed from day to day and from hour to hour.

Attention has been sharply called to this danger by a report just submitted to the Board of Fire Underwriters. It appears from this report that we have on the North River front over four and a half miles of wooden sheds, nearly all of them constantly stored with inflammable materials. Out of 62 of these pier sheds only 16 have iron roofing; 19 have no hose; 8 have absolutely no appliances for putting out fire; only 7 have watchmen equipped with watch-clocks; there are boilers on 15 piers, and blacksmith or carpenter shops on 10. During the winter season the water is shut off from all the pier hydrants at night. Some of these piers are separated from the great dry goods district only by blocks of old wooden houses. Superintendent Harrison tells the Board of Fire Underwriters that in these long, narrow piers, some of them over 700 feet in length, heaped with merchandise and covered with wooden roofs, "the elements of a large and serious conflagration are far more apparent" than they were in the case of either Chicago or Boston.

He would have these sheds torn down and replaced by corrugated iron sheds on iron frames. This would cost a great deal of money, but it might prove sound economy in the long run. With such violent west winds as we have here every winter, a night fire on one of the North River piers might make a clean sweep to Broadway, and perhaps across the whole city to the East River.

Hight of Work for Filing.

Various ideas very naturally exist among mechanics as to the hight at which the jaws of a vise should be set from the floor for use in filing, arising, no doubt, from the varied nature of the work upon which the advocates of the different ideas have been accustomed to operate. In the "Treatise on Files," issued by the Nicholson File Company, of Providence, R. I., the following points are laid down:

For general work, the top of the vise jaws should be placed so as to be level with the elbow of the workman, which will be found to range from 40 to 44 inches from the floor, therefore 42 inches may be considered as an average hight best suited for all hights of workmen, when the vise is to be permanently fixed. If the article to be filed is small and delicate, requiring simply a movement of the arms, or the right hand and arm alone, the vise should be higher, not only in order that the workman may more closely scrutinize the work, but that he may be able to stand more erect. If the work to be filed is heavy and massive, requiring great muscular effort, its surface should be below the elbow-joint, as the operator stands further from his work, with his feet separated from 10 to 30 inches, and his knees somewhat bent, thus lowering his stature; besides, in this class of work, it is desirable to throw the weight of the body upon the file, to make it penetrate, and thus, with a comparative fixedness of the arms, depend largely upon the momentum of the body to shove the file.

It will be seen, therefore, that in fixing the hight of the vise, the nature of the work and the stature of the operator should be considered, if it is deemed necessary to apply the principle correctly.

How Gaslight is Lost.—Computations of the loss of light by shades of different kinds have been brought together by Prof. Chandler, and are presented in a pamphlet entitled "How to Burn Gas." The lowest absorption of ground glass is nearly 30 per cent; there is only one specimen at this low figure, other shades of that kind absorbing more than 62 per cent. Opal glass causes a loss of 53 to 56 per cent; green, purple, and ruby glass, 82 to 89; and a porcelain transparency, over 97½ per cent.

Constructive Carpentry.

CONTINUED FROM PAGE 11.

The adjoined Fig. 4 represents an irregular roof on an irregular building, occupying the corner of a block where the streets meet at an angle *f*, which is not a right angle; *b f* fronts on one street, and *e f* the other. As it is an illustration of a very difficult roof it will suffice for other similar cases. A first condition is to make the roof look as regular as possible from the sides of the streets, and for this purpose the naves must run parallel with the two front walls *b f* and *e f*. In order to find their positions, the lines K K and K K′ are drawn perpendicularly to these fronts and bisected; through the points of bisection, the line for the nave 4 4 is run parallel to *b f*, and 4 *m* parallel to *e f*; the pitch of the sides along the line *a b* and 1 2 3 4 and *f* along *e f*, is determined by bisecting the angles at *b* and at *f*. To find the beams the space *a* 4 is divided into four equal parts, the line *a d* prolonged until it meets the line *e f*, and the corresponding space in *e f* also divided into four equal parts, when the lines 1 1, 2 2, and 3 3 are drawn, which, where they cut the oblique lines, determine the length of the rafters. Along the line *a d* the corresponding space is also divided into four equal parts, and lines drawn parallel to *a b*. These lines will cross the preceding ones at the hip, and represent the horizontal projection of the oblique space.

In order to obtain the vertical bend in the profile, Fig. 5, half the length is divided into the same four equal parts as the line K K, and perpendicularly drawn down to the line of incline; the points of intersection are then set off on the space and brought to the same hight as the corresponding points. By uniting the points the twist of the roof is found. For the extension wing K *c e* K′, Fig. 4, the same operation is performed, which will at the same time determine the position of the valley *n m*; as the ridge *l m* is lower than the ridge 4 *n*, there is an oblique ridge *n m*, descending from *n* to *m*, the inclined position of which is a necessary consequence of the preceding.

The difficulties sometimes experienced in making, on irregularly shaped buildings, such oblique roofs look as symmetrical as possible, has induced many architects and builders to adopt flat or mansard roofs in such cases. They are especially to be recommended when the buildings cover considerable ground, as in this case ordinary slanting roofs become too high, and do not look well. Mansard roofs are especially to be recommended in cases of this kind, and the one on the New York Post Office is a fine example of this style of roof. It is built on a very irregular, 4-sided ground-plan, with an interior triangle area. A flat roof would give to such a building an unfinished appearance; but a high dome, crowning the main front, with a mansard of uniform hight and slope, covering the rest of the building all around, gives it a highly pleasing finish.

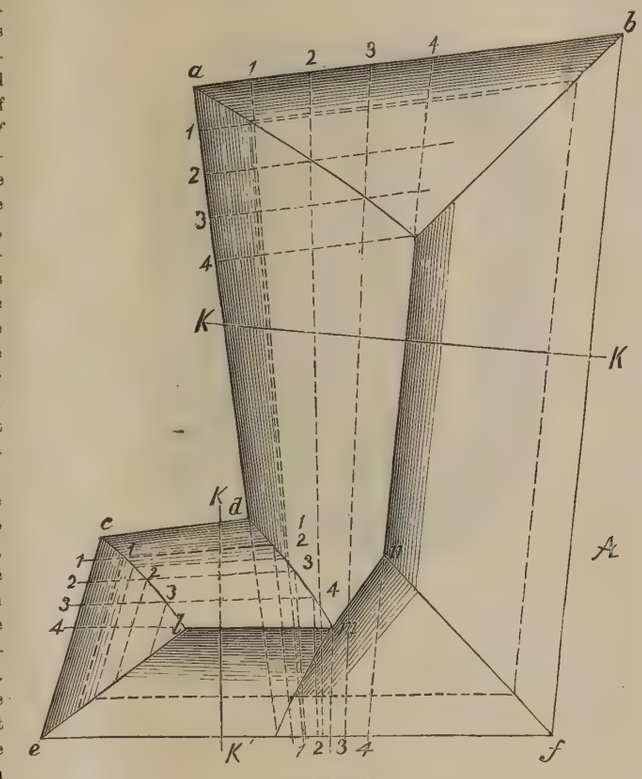


Fig. 4.

Fire-Proof Construction.

Absolutely fire-proof buildings, says the *Buffalo* (N. Y.) *Courier*, are by no means plenty in any city, and Buffalo has very few in proportion to its size. What constitutes safe construction has long been a subject for thought and investigation by architects and builders, and what to the ordinary observer would seem perfectly indestructible by any fire, would display perhaps a hundred vulnerable points to the practiced eye of an expert. The popular fallacy that iron buildings are necessarily able to resist fire, has been disproved again and again by actual experience. Captain Shaw, chief of the London fire brigade, writes the following upon this point: "No fireman has ever seen a stone stair-escape, or an internal wall, supported on iron, that can be relied upon where there is much heat." He cites the case of a building now going up at the corner of two streets, where the entire structure is supported on iron columns without any wall, wood or brick, reaching to the ground along the whole line of the front. "This building," he says, "at the ordinary temperature of from 600° to 700° Fah., must inevitably fall, and such a temperature could easily be created by the combustion of a small quantity of furniture."

Such a statement from so reliable a source, is pretty conclusive evidence that iron columns, unless protected from even the small fire that could be made of the furniture in a room, are by no means a safeguard in case of fire, but rather a source of danger. The remedy, and the only sure protection, is to encase iron columns in brick or plaster, so as to give them a fire-proof and non-conducting coating. Iron doors and window-shutters, while protecting a building to a certain extent from flying sparks or light flames, are perfectly worthless where a moderately intense heat is directed against them. In mills where iron doors have been used to prevent fires from spreading from one room to another, they have proved to be not only useless, but an actual source of danger. So clearly has this been shown, that about a year ago a Boston insurance company made this the subject of a special circular, warning manufacturers against their use, and giving facts to prove the importance of taking out iron doors and replacing them with wooden ones protected by a covering of tin or sheet-iron. The reason why wood is safer than iron, is that an iron door will warp easily and let fire through, while wood covered so as to exclude air, will only char slightly, still retaining its shape and accomplishing its object.

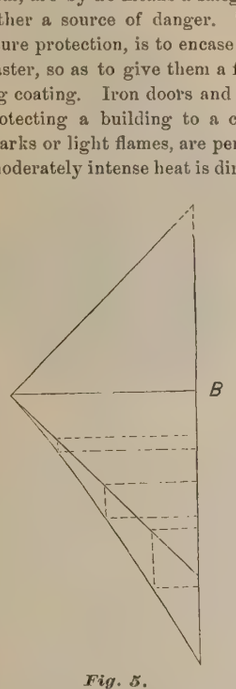


Fig. 5.

In the same way wooden beams, when properly covered with plaster or other materials to exclude air, are safer than iron, because they do not lose their strength when subjected to heat. In a building used, for instance, as a storehouse for inflammable substances, brick and wood properly covered, are the only really safe materials. We believe that iron, as a building material, will be used more and more extensively, but it is as well to understand just what its defects are, so that impossible results will not be anticipated. The whole matter of the selection of proper materials for buildings in cities, and the proper method of using such materials, has been sadly neglected in this country, and the result is seen in such great fires as those of Chicago and Boston. We believe that about eighty cents in one hundred dollars are destroyed annually by fire in the United States, while in Europe only about one-third of this amount is lost. Some of these days Buffalo will contribute a sorrowful chapter to the history of great conflagrations, if its present methods of construction are not improved. If, on the testimony of such men as Captain Shaw, even our fire-proof buildings are really combustible, what shall be said of the shingle roofs and frame buildings to be found in nearly every block of the city?

American Cutlery in Sheffield.

It is related that Senator McPherson, of New Jersey, who is now abroad, was introduced, before leaving New York, to an English gentleman who was buying American cutlery to export to Sheffield. The Senator said he was surprised at this; the idea of manufacturing cutlery in this country to send to Sheffield was more strange than that of sending coal to Newcastle, for anthracite could be sent at a profit to the latter place. The Senator asked the gentleman what in the world he could do with American cutlery in competition with the world-renowned Sheffield cutlery at his door. The Englishman replied that he had contracted with a Connecticut manufacturing firm for $250,000 worth of cutlery, to be stamped with his Sheffield trade-mark, because he could get it delivered in Sheffield ten per cent cheaper than he could manufacture it himself.

"But," said the surprised Senator, "how about the quality of the cutlery you have contracted for—how does it compare with the celebrated cutlery of your country?" "Sir, it is, if anything, superior. You have the best steel in the world, and with your labor-saving machinery you can manufacture the best of cutlery cheaper than it can be done anywhere else. Your financial troubles, resulting in the cost of everything—including labor—being reduced to hard pan, will prove in the long run to be the best thing that has happened to your country. You will soon be competing with Europe for the markets of the world, and the time is not far off when you will rank with England as a manufacturing nation."

LAYING DUST IN STREETS.—A solution of chlorid of calcium has been used in Rome as a substitute for water in laying dust in the streets. The experiment is said to have given satisfaction. The dampness communicated to the road, instead of disappearing quickly, as is the case when water alone is used, remains and leaves the road muddy. Mud may be better than dust, but it must be observed that this is an old device, and has been condemned by physicians as unwholesome.

Contribution to the History of the Electric Light.

In view of the interest taken at present in the perfection of machines for producing electric light, it may be interesting to republish the follow extract of an article from the *Journal of the Franklin Institute*, Philadelphia, for December, 1861, containing a report of the transactions at one of the meetings of the said Institute, at which Mr. A. L. Fleury, chemist and electrician, read the following papers:

"Can light, heat, and motion be successfully and economically produced by electricity? This is a very important question, and it is for our present fast-progressing century to answer it by practical demonstrations. Electricity acts the most important part in the mineral, vegetable, and animal economy; it has been proved to be identical with the vivid and withering lightning, the streaming aurora borealis, the rapid whirlwind, the terrific waterspout, and may probably be the cause of the falling meteor and the devastating earthquake; it seems to be the connecting link between mind and matter—figuratively speaking, electricity is the soul of nature. The successful experiments of Prof. Faraday, showing the advantages of the electric light for light-houses, and also the brilliant trials made in Paris, give evidence that our neighbors over the water are on the *qui vive* in this most important subject—the production of light by electricity. Not only this subject, but also that of heat has been taken into consideration. As proof, I present here an article published recently in the London *Times*:

"A Trappist named Delalot-Sevin, of the Abbeye de la Grace-Dieu, has made a discovery which will probably produce a revolution in the system of lighting and heating public and private buildings. He has invented a new pile much stronger and at the same time cheaper than the pile of Bunsen. By means of his photo-electric apparatus he produces an electric light as cheap as gas; and with his thermo-electric pile he supplies caloric on economical terms hitherto unknown. Several of these apparatus have been constructed, and one is at full work in the Abbeye de la Grace-Dieu. Manufactories for the public are shortly to be established in Paris and at Lyons. The apparatus for producing gas will not be given to the public until after the exhibition at London next year; but that for heating buildings will be made public on the 16th of December, 1861. The inventor has been authorized to make public experiments with his system of lighting on the Place Saint Jaques in Paris, and also on the Place Bellecourt at Lyons."

I shall present to you this evening a communication of great importance on one of these subjects—the production of light and chemical decomposition (electro-plating) by a new magneto-electric apparatus, the invention of Dr. P. H. Van der Weyde, Professor of Chemistry and Physics at the Cooper Institute, New York. This gentleman has experimented for years past on magneto-electricity, and his communication is of interest and value. It is a remarkable—I may, perhaps add, providential coincidence, that this communication has been followed by another coming from a different source.

Mr. Fleury then read and explained by diagrams the following descriptions of new magneto-electric machines, constructed on a principle differing from the usual method, by Prof. Van der Weyde. He writes:

"Last winter I read a paper before the Polytechnic Club of the American Institute, on the different methods of producing and using electricity to ignite inflammable substances. I exhibited the drawings and models of a few magneto-electric machines of my construction, adapted to ignite gas or gunpowder, by means of a magneto-electric current. An extract from this paper and reports of the experiments performed are to be found in the 'Transactions of the American Institute' for 1860, in a January number of the *Scientific American*, and in the *American Engineer* for January 10, 1861. I have since made numerous experiments to find the most advantageous arrangements to obtain the different purposes those machines may be intended for, having constructed small working models, and am now preparing two different and very effective machines on a large scale.

Before speaking of my investigations since then, I will first in a few words describe the four new machines explained at that time, as this will serve to make better understood the advantages offered by the two arrangements I have finally adopted. In each of my new arrangements my purpose is (as the name Magneto-Electric indicates) to entirely do away with the cumberous and expensive galvanic batteries which are the

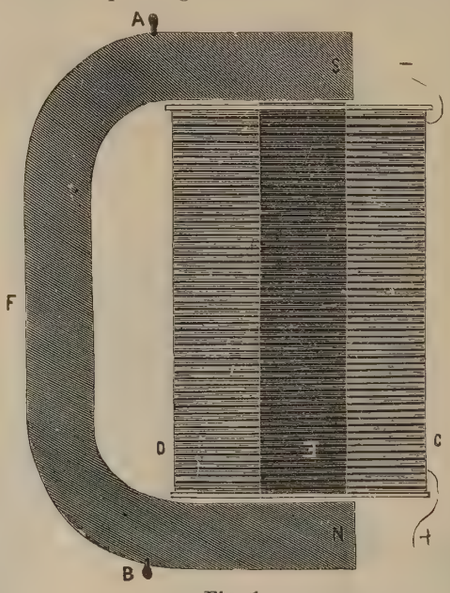


Fig. 1.

main objections to the use of the Ruhmkorff coil, and other arrangements made after the same principle, and to substitute for the battery the action produced by permanent steel magnets, moved by some mechanical power. The question was only to arrange a given

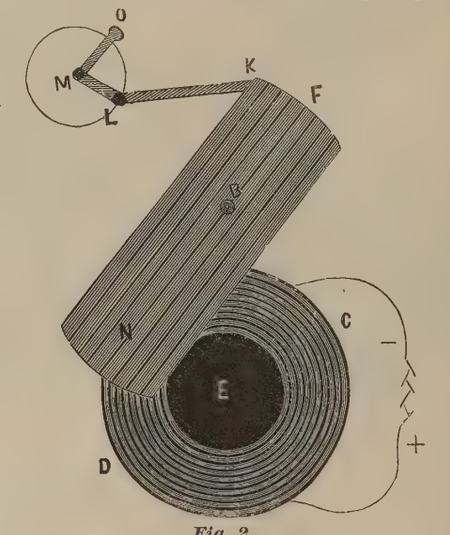


Fig. 2.

quantity of steel so as to obtain the strongest permanent magnetism, and to arrange a given quantity of insulated copper wire so as to obtain by that magnetism put in motion the greatest amount of electricity.

First Arrangement.—Of the first arrangement I contrived, the principle is represented in Figs. 1 and 2, the first being the front and the second the side view of the apparatus. It is an imitation of the Ruhmkorff coil, except that instead of magnetizing the central iron core E by the current from a galvanic battery, (passing through a coil of thick wire, around which the long thin wire is wound), in this arrangement the central iron core is magnetized by a bundle of horseshoe magnets, oscillating around a pivot A B, and passing with their poles close along the extremities of the iron core. By this arrangement the central thick wire is entirely dispensed with; the thin wire of several thousand feet in length is wound directly on the insulating glass or India rubber surrounding the core, and also wound in sections, as is the case in the improved apparatus of Ruhmkorff, by which means, united with the perfect insulation of the windings from the core by glass, India rubber, etc., a long spark is produced.

I do not wish to have the value of this arrangement overestimated, and therefore will also mention its disadvantages: 1st. The thick primary wire being omitted, the condenser, which increases the spark of Ruhmkorff's apparatus, and which is connected with this wire and the battery, cannot be here applied. 2d. The magnetism cannot be so suddenly excited or neutralized in the central core, by the passing of the steel magnets along its extremities, as is the case in the Ruhmkorff coil, by making and breaking the contact of the battery; the suddenness of this operation constituting one of the sources of its efficiency. 3d. The central iron core cannot be magnetized so strongly by the passage of the magnets along its extremities, as in the core by the passage of the galvanic current through a wire surrounding its whole length. This last disadvantage, however, is more or less compensated for by the closer proximity of our long wire to the central core, of which the magnetism is the principal source of the intensity current, giving sparks, in the long wire, as is sufficiently known. I mention these particulars because, as has been stated above, they are useful—nay, necessary to understand the subject in question, and will also serve to appreciate the advantages of my other arrangements.

Second Arrangement.—The horseshoe magnet S E N, Fig. 3, consisting of three or five superposed laminæ, is rounded off at the poles, around which the two coils A B and C D are wound; F G represents the soft iron keeper, revolving around the axis H K, by means of the crank N and the intervening wheel-work M L. A small working model of this machine, intended to prove the correctness of the principle that the coil may be advantageously wound round the steel magnets, is now in the hands of Prof. Fleury in Philadelphia. Its dimensions are so small that it can be carried in the pocket without the least inconvenience; for this reason I have it specially arranged for medical purposes, and attached to it the usual contact breaker and commutator of good medical magneto-electric machines. It is found to be as strong as many large machines of this kind of 10 to 20 wounds in weight, and amply sufficient for all medical applications.

This arrangement (which I find to have been made in France some four years ago) has two defects: 1st. That the whole magnetic power of the steel is not taken advantage of, by winding only the extremities. 2d. That by revolving the soft iron in front of the magnet we have no perfect contact, and do not make all the magnetism latent, thus exciting the current only with the difference of the full and a greatly diminished power. I have succeeded in obviating these difficulties by two separate arrangements.

Third Arrangement.—I have taken two steel bars, each composed of a bundle of five or seven laminæ, strongly united and rounded off; each is surrounded by a hollow cylinder of glass, India rubber, or any other good insulating substance, of the same length as the bars, and open at both ends; around these the coil is wound for the whole of their extent, observing two things: first, to wind it in sections, as the Ruhmkorff coil, to insure more length of the spark; second, to so distribute it over the length of the magnetic bars that most of the coil will be where the greatest magnetic intensity resides—that is, toward the extremities. The two bars and coils are then horizontally attached to a board, or placed in a box, equally distant from and parallel to an axis, which is a little longer than the steel bars.

In Fig. 4 N S represent the steel bars and coils, and E F the axis; at each extremity of this axis is attached a keeper A B and C D, at right angles, and at such a distance that by turning the axis the keepers pass with their ends very closely along the extremities of the steel magnets, which of course lie with the opposite

poles toward the same keepers. It is clear that in this arrangement we have the advantage of the whole magnetic surface of the steel magnets, being made available by the coil, and at the same time working with an apparatus more than double the power of that represented in Fig. 3, and exactly of the same dimensions.

The remaining disadvantage of imperfect contact of the keepers and magnet, is entirely overcome in the following:

Fourth Arrangement.—I take two strong horseshoe magnets, having polished cylindrical extremities E and F, and place them horizontally on a board or in a box, touching each other with their opposite poles N S, which are situated in two coils A B and C D. These coils, wound with well insulated copper wire, are immovable, and fixed to said board. One of the magnets must slide in and out of the coil, and may be suddenly separated from the opposite fixed magnet which attracts it, by means of a strong lever. The moment this is done, the magnetism of the two magnets (before made latent by their contact) is suddenly set free, and an electric current induced in the coils; by joining the magnets again, a current will be developed in the opposite direction, which, if desired, may be led in the same direction by means of an appropriate commutator attached to the lever.

The machines represented in Figs. 4 and 5 have both peculiar advantages, which adapt them to perform electric labor of a different nature, which I will now explain.

In the machine represented by Fig. 4, the contact cannot be absolute, and therefore the magnetism of the steel magnets is not so entirely neutralized as in Fig. 5; hence the electric power of Fig. 4 is due to the difference in the full magnetic power of the steel, and its power diminished by about 98 per cent. In Fig. 5 the magnetism is almost entirely destroyed by the absolute contact, so that scarcely a trace is left; however, to compensate for this slight defect in machine Fig. 4, the latter is apt to run with great velocity, while Fig. 5 is not. Fig. 4 is therefore appropriate for the following purposes:

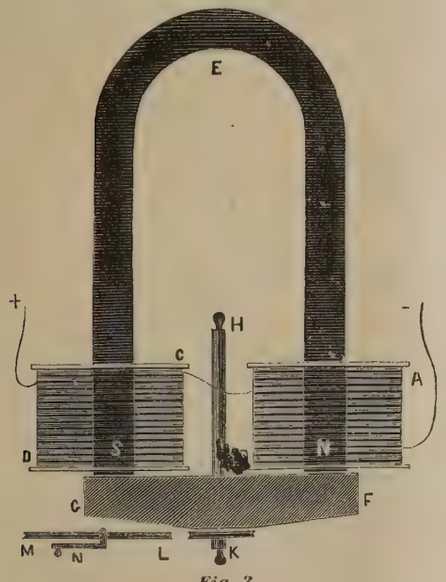


Fig. 3.

1*st. For Electro-Plating,* if a series of medium sized machines are constructed, connected by thin coils, and moved together.

2*d. For Chemical Decomposition.*—If these series are so constructed that the connection of their coils may be arranged differently, either for intensity or quantity; as the coils and magnets are all stationary, it is exceedingly easy to change these connections, even while the machine is running, till the intended result—chemical decomposition—is obtained. However, as I find the law of Ohm (that the resistance in the conducting wire or coil must be equal to the resistance in the liquid of the battery) applicable to these machines, in which the resistance of the coil must be equal to the resistance in the chemical solution to be decomposed, we may, by calculating the resistance which this liquid offers to the electric current, connect the coils in such a way as to make the resistance in them equal to that in the liquid, and thus arrange the connections *a priori.*

3*d. For Medical Purposes*—if the machines are constructed on a small scale, and provided with a commutator, as in the machine (Fig. 3) now in the hands of Prof. Fleury.

4*th. For Electric Light*—if the precautions in the construction are adopted which I have found by many successful experiments to be necessary to secure a long

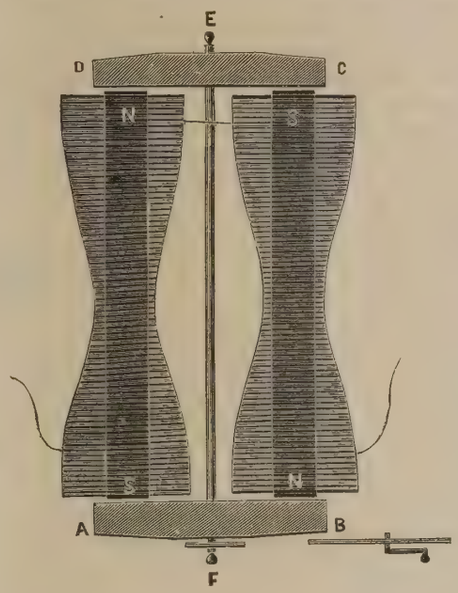


Fig. 4.

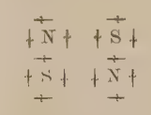
spark, and which thus far has never been obtained in machines of this kind. Of these precautions and peculiar arrangements I will speak hereafter. They are of absolute necessity for the apparatus represented in Fig. 5, which is the great desideratum so long sought for and wanted for military purposes.

5*th. For Igniting Gas, Gunpowder, and other Inflammable Substances.*—For this purpose the machine, Fig. 5, is to be constructed with special regard to obtaining a single but very powerful spark.

To obtain such a spark, the precautions are: 1st. To have the magnets carefully rounded off at the poles, well fitting, and exactly filling the openings in the coils. 2d. To have the ends well ground on a plane, so as to secure a perfect contact. 3d. To insulate the coil carefully in winding it over the glass or India rubber, to prevent the spark from losing its intensity and length by discharging partially through the magnets, as is the case in all other machines; also to avoid the mistake of having metallic or other conductive rings connected with these coils, which absorb a part of the inductive electric effect of the magnets at the expense of the coils.

The necessary peculiarities of the arrangement are: 1st. To construct each magnet of a bundle of smaller magnets, each of such size and shape as have been found by Lamont the most effective. 2d. To insulate the extremities of all these small magnets from one another, so as to prevent the circulation of any electric current in the bundle of magnets, (to the production of which there is a tendency), and thus to force all the magnetism producing the electric current to be exerted in the coil alone. 3d. To wind the coil in a peculiar way, (described in Poggendorf's *Annalen* a few years ago), to insure longer sparks. A single apparatus of this kind suffices for igniting gas or gunpowder by means of some easily explosive compound, as I have proved by experiment, even with the old apparatus. Where, however, more intensity is required to make it work at greater distances, a battery of such coils as Fig. 5 is to be arranged by placing the magnets vertically—the upper ones fixed and the lower ones movable, so that by the downward motion of a powerful lever, they may be at once separated from the upper, each pair surrounded by its coil.

The way these poles have to be arranged, is for the lower magnets (that is, those having their poles turned upward, if we look from above down on them) here represented; N signifies the north pole, and S the south pole of each horseshoe; the arrows indicate the direction of the current in the coils, and the way these coils must be connected.



It will be seen how, by this arrangement, every pole assists the currents in the coils of the neighboring opposite poles; these four poles are neutralized by the contact of the opposite poles of the upper inverted magnets, but this inverted position brings the current in the same direction.

For sixteen poles, the arrangement would be thus, the arrows again indicating the direction of the current:

Such a combination will require the full power of one or two men to separate the sixteen poles by means of the lever, but by my careful and peculiar arrangement, will give an electric spark equivalent to the power applied, and will act at any distance which practically may be wanted, only requiring the common precaution for insulating the conducting wires.

The patents applied for cover all the essential parts of the machines represented in Figs. 4 and 5, as well in their single construction as in their combination to a powerful battery, and the use of this battery for the purposes mentioned, as also for such effects as can be

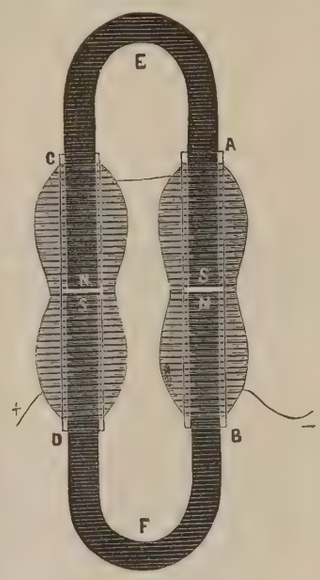


Fig. 5.

produced by any ordinary electric machine or galvanic battery.

Heat Conductivity.—Experiments lately made by M. Schuhmeister on the heat conductivity of cotton, wool, and silk, by a method similar to that employed by Stefan for determining the conducting power of gases, have led to the following results: The heat conduction of air being considered =1, that of cotton is (on the average) =37, sheep's wool =12, and silk =11; the cotton and wool were unwrought. The latter was washed merino wool; the silk was in the state of cocoon fibers.

Ignorance as a Cause of Boiler Explosions.

We continue our series of articles upon the boiler explosions that occurred during 1877, by giving here two cases; one demonstrating the ignorance of the owners of boilers regarding the necessity of proper inspection by responsible and expert parties, (such as the Hartford Steam-Boiler Inspection and Insurance Company, of Hartford, Conn.,) while the other illustrates the ignorance of an engineer, who did not know the danger connected with the injection of water into an overheated boiler, in which the water had become too low, and the necessity of having adequate safety-valves, and keeping them always in working order.

The first case is represented in Fig. 1; it was a horizontal boiler, 24 feet long and 42 inches in diameter, with two flues. It was stated at the investigation that only 50 pounds of steam was being used. The original thickness of the iron was only $^3/_{16}$ of an inch. At the point of rupture the iron was corroded to the thinness of paper. No person was hurt, but the building was badly damaged. The engraving represents the appearance of the boiler after the explosion.

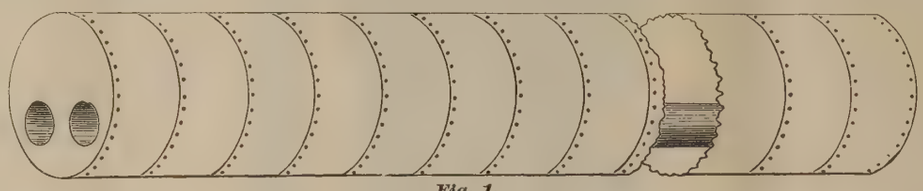


Fig. 1.

It is reasonable to suppose that if the boiler had been thoroughly inspected, the defect would have been discovered and the accident prevented. There are steam users who fail to appreciate the advantages of thorough inspection; a "certificate," if secured at a very low rate, is all that is wanted. As the government inspectors are not responsible for the bursting of boilers, they can afford to give certificates much cheaper than parties who make themselves responsible by insuring the boilers; any defect discovered is corrected, and the owners guarded against damage, which is always unavoidably connected with explosions; if they were wise they would make use of the opportunity of receiving advice from responsible parties.

The other case, which shows what ignorance or recklessness (probably the first) on the part of the engineer may lead to, was this: A boiler of the locomotive type—a variety used in the oil regions of Pennsylvania—having a narrow base to the fire-box and a tapering waist; base, 26 inches wide by 4 feet 4 inches long; fire-box, 20 inches wide by 3 feet 10 inches long; front, 4 feet high by 3 feet wide at the axis; dome, 22 inches in diameter by 30 inches high, measured from the crown of the shell; length over all, about 12 feet; diameter of barrel, 30 inches, containing 28 tubes 3 inches in diameter by about 8 feet long; thickness of shell, dome and fire-box, $\frac{1}{4}$ inch; tube sheets, $^5/_{16}$ of an inch. The boiler was located in an open field some distance from the works, and covered by a shed; it was used to furnish steam for a small pumping-engine in a large well which was in process of excavation. The boiler as it originally appeared is shown in Fig. 2. When the accident occurred (on a Sunday about 3 A. M.) two men were in or near the shed; one was instantly killed and his body thrown a distance of 120 feet from the shed; the other, who acted as engineer, was thrown a considerable distance and fatally injured; he died the following Wednesday. He said he had just started the injector to feed water into the boiler, when she exploded. The shed was literally reduced to kindling-wood and scattered over several acres of ground. The boiler was torn into twelve principal fragments, besides small pieces of plate, stay-bolts, and braces, which were scattered in all directions. The barrel of the boiler containing the tubes was thrown end over end, nearly in a line of its axis when in position, a distance of about 200 feet, the tubes left bare by the tearing off of the waist, plunging into the ground, whence it bounded some distance further, near the place where the taper-sheets that formed the waist had alighted.

Most of the other parts were strewn in a curved line to the left, each piece going further until the most remote and largest landed about 1,500 feet to the left. The crown and sides of the furnace were composed of one sheet, which seems to have been flattened down upon the grate bars, then turned once over upon the ash-heap, with its fire side up, and the fusible plug in perfect order in the middle of the sheet. A part of the tube-sheet, with half the wrought-iron base-sill attached, was dropped upon the tool-box of the diggers. The front of the shell, with the front of the fire-box attached, was thrown about 600 feet in a direction nearly opposite to that taken by the barrel.

Nothing remained to mark the spot where the boiler stood except the grate-bars, which were forced into the ground that formed the floor of the ash-pit.

The boiler was nearly new, and fitted with a common lever safety-valve and three gauge-cocks. The fire-box was stayed to the shell by screw-stays, spaced about 5½ inches apart, and headed over inside and outside. About 20 of those that supported the furnace-crown were attached in the same way to the 24-inch circle of the shell enclosed between the flange-rivets of the dome.

The whole load upon a 24-inch circle of the center of the crown-sheet, at 120 pounds per square inch (a pressure that the safety-valve, with the weight at the end of the lever, even allowing it to be in working order, would have permitted), was 54,000 pounds, or 27 tons. The body of the safety-valve was tapped to receive the steam-pipe from the boiler, also the steam-pipe to the engine and the escape-pipe from the space above the valve, in the usual manner. The wings of the valve fitted nicely into the chamber, and the tendency of the long steam-pipe, perhaps not properly supported, or twisted out of its natural easy position, acting as a long lever on this valve body, distorted the parts and pinched the wings so that no ordinary force could move the valve from its seat. It is said that this boiler had been worked at a pressure of 130 pounds, which would probably be quite sufficient to weaken this weak part of the boiler, and the disaster may have occurred from want of strength to sustain such a load any longer.

The pump, which was located a considerable distance from the shed, may have stopped from accumulation of condensed steam (water) in the steam-chest. The steam would rise until the weakest part gave way, and with an inoperative safety-valve, no warning would be sounded to rouse the drowsy attendants. The wreck is shown in Fig. 3.

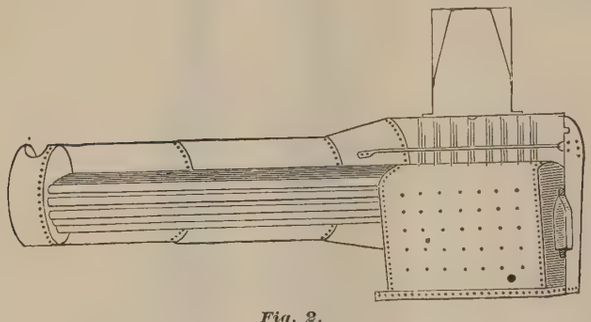


Fig. 2.

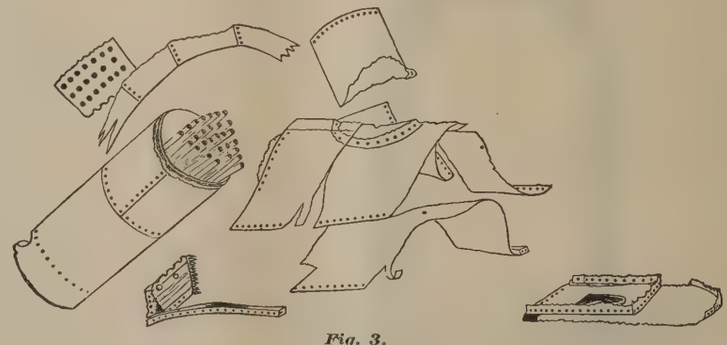


Fig. 3.

Firemen's Respirators.

The Springfield (Mass.) *Republican* says that Chief Engineer Leshure has had sent him for trial a couple of patent respirators, or contrivances by the use of which firemen are enabled to remain in the thickest smoke. One, which is used considerably in New York and elsewhere, consists of a common bag strapped upon the fireman's back, into which air is pumped. A couple of rubber tubes connect this with a mouth-piece, and a spring with two legs is attached to slip over the nose. The fireman thus breathes out of and into the bag, and can live until the air is exhausted.

The other device is composed of a rubber mask, with eye-pieces, etc., something like a diver's hemlet; a bulb, perforated with numerous holes for the passage of air, filled with sponge, and connected with the helmet by tubes, and a small bag, connected with this bulb, to hold water, which, in the process of breathing, is drawn up into the sponge, thus keeping it wet and purifying the smoke-filled air that passes through it. Both contrivances appear to be suited to practical use.

Chief Leshure, however, is getting up an apparatus of his own that is much simpler than either, and is apparently likely to work as well. In its perfected form it will have a hemlet something like the one described above. Directly in front of the mouth-piece is a cylinder about 2 inches in diameter and 3 or 4 inches in length, having the ends perforated for the passage of air, and being filled with two layers of sponge and an intermediate one of charcoal. A reservoir on top of the cylinder can be arranged to hold water, which can be admitted to the sponges through a stop-cock, so as to keep them constantly wet, to purify the smoky air. It is claimed that this apparatus is the simplest yet thought of, and Chief Leshure proposes to make a success of it.

Combination Revolver and Pocket-book.—Otto Frankenau, an ingenious German, has invented a combined revolver and pocket-book, which, in a country infested with footpads, might be a very convenient thing. The purse has the outward appearance of a somewhat thick portemonnaie, and the pistol is secured to the metal framework on the left-hand side when the muzzle is pointed forwards. On the right-hand side there are the ordinary pockets for money, and on the left-hand side the purse opens in the same way, to allow the pistol to be cleaned and loaded. By touching a spring in the framework a little trap door opens and discloses the muzzle, while at the same moment the trigger falls down from below. The revolver has five chambers and Eley's five-millimeter cartridges. The idea of the inventor is not only to afford a means of carrying a pistol without displaying it, but also that a

thief might be shot in the very act of appearing to comply with his demand for money. The mechanism is very simple and works easily and well, and the pistol, although concealed, can be levelled with sufficient accuracy for its purpose as a weapon of defence at close quarters. In order to fire it, a rather strong pull on the trigger is required, so that there is practically no danger of discharging the pistol accidentally when using the purse for its declared purposes.

Scientific.

The Theory of the Gyroscope Again.—We read the following in the New York *Herald* of January 25th:

"A new law of motion—an exposition of the mysteries of the gyroscope.

"The discovery of a new law of motion at this time of the day might be considered somewhat apocryphal, and that a clear solution of the mysteries of the gyroscope was not within the grasp of the ordinary man of letters. And yet one of our citizens of Irish birth, Mr. James McCarroll, appears to have demonstrated the one and to have accomplished the other, the proofs of which, so far as we are able to judge from a hasty glance, now lie before us. Mr. McCarroll avers that all bodies moving in right lines change their distance from the center of gravity, and, consequently, their weight at every moment, and that when moving in curves, whether concentric with the circles of the earth or otherwise, the tangential force, antagonizing with that of gravity, serves to change their weight also. Hence he lays it down as a fourth law of motion that 'a body is of uniform weight when at rest only.'

"In relation to the mysterious problem of the gyroscope—which has, we believe, never been satisfactorily solved previously—his solution is seemingly quite clear. In fact, he appears to demonstrate that a vertical wheel in motion does not press upon the same points of its bearings that it does when it is at rest, from the fact, as he alleges, that all the particles of matter in the periphery on one side of the wheel have a tendency to fly off at various angles in the line of the earth's gravity, and one of them directly in that line; while all the particles in the other half of the periphery have a tendency to fly off in a contrary direction, establishing an unequal distribution of force upon the axis, and a minus and plus side of the wheel; as on the one side we have the earth's gravity, plus the tangential force of the wheel, and on the other its gravity, minus that force. This once admitted, the motion of the horizontal ring on which the vertical wheel revolves is apparent at once; for the ring, being free to obey any impulse given it in its own plane, simply retires before the plus side of the wheel and in a direction contrary to the revolution of the wheel itself. In explanation of the mysterious manner in which the whole weight of the gyroscope is sustained on one side of the upright pivot upon which the small projection from the horizontal ring rests freely, Mr. McCarroll says that when the vertical wheel is made to rotate so rapidly that the tangential force is in excess of that of gravitation on the whole mass, both ring and wheel will remain suspended without any material support on one side of the upright and be carried round the pivot upon which the projection from the ring rests, revolving more rapidly as the tangential force of the wheel decreases and is the more readily bent out of its plane, until, falling below the force exercised upon the whole mass by the gravity of the earth, both ring and wheel begin to gradually describe downward the arc of a circle vertical to a line tangent to the earth's surface, with the pivot for its center, and the axis of the wheel, together with the projection of the ring, for its radius, until at last the exhausted mass tumbles to the ground."

After reading the above, we wrote down a few of the salient points which proved the error of what Mr. McCarroll calls a fourth law of motion, and sent it to the *Herald* for publication; its insertion, however, was refused. So much for the desire of that paper to do justice for the sake of scientific truth.

This pretended new law of motion, claimed to have been just discovered, is an old error, easily disproved by direct experiment, and besides is utterly contrary to all the principles of correct science. The very hypothesis, that bodies in motion lose part of their weight, was propounded in 1858 as an explanation of the motion of the gyroscope, and thoroughly discussed at several successive meetings of the Mechanics' Institute in New York. We quickly settled the matter by placing a gyroscope on the scale of a balance and showing that its weight was exactly the same same whether it laid still or was rotating on its pivot, which proved that the only difference was, that during the rotation, the pivot carried all the weight of the revolving disk, and that consequently the weight was not in the least diminished during the rotation.

But on a little reflection, it is even *a priori* clear that the assertion, "a body is of uniform weight when at rest only," (called a fourth law of motion), must be utterly false. Are not, by the daily rotation of the earth, all the bodies on its surface, in rapid motion? Bodies under the equator move in 24 hours through a distance 25,000 miles, or more than 1,000 miles an hour—a velocity surpassing 20 times that of the swiftest express train. They do not lose more of their weight than is due to the centrifugal tendency produced by the curve they describe, which curve is a part of a circle so large that, practically, for the distance of several miles it may be considered as a straight line. The theory of the moon, established by Newton, proves that this body, which moves with a velocity of more than 2,000 miles per hour through a much larger circle, is attracted by the earth precisely as much as if she stood still; indeed if this were not the case, it can be proved that then she would fly off at a tangent, and our earth would long ago have lost her moon.

But perhaps Mr. McCarroll does not believe in the rotation of the earth, nor in the great distance of the moon, which is likely, judging from his crude theories. In that case we point out to him the fact that a cannon-ball, when projected horizontally from an elevation, descends just as much every second of its flight as it would if simply allowed to fall perpendicularly—that is, very nearly 15 feet in the first second, 3×15 or 45 feet in the second, 5×15 or 75 feet in the third, 7×15 or 105 feet in the fourth, and so on. However, a slight deduction must be made in the latter numbers, by reason of the resistance of the air, which increases as the square of the velocity. Now if the terrestrial attraction on the horizontally moving ball were less than it is on a ball not thus moving, it would descend less in every second; but as the descent is the same, we must conclude that its rapid horizontal motion does not diminish its gravity in the least. If, now, even a cannon-ball, moving at the rate of some 2,000 feet per second, does not lose its weight, much less will the revolving disk of a gyroscope.

The above will suffice to show that the author of that pretended law of motion has no knowledge of the elementary principles of natural philosophy, nor of mechanical science. But this is not the first time that persons have come forward with the belief that they had discovered something new and correct. The law claimed to have been discovered by Mr. McCarroll is neither new nor true; it is, in fact, an old, exploded error.

Production of Animal Force.—Prof. R. A. Witthaus, of the University of Vermont, delivered a lecture recently in this city at the Cooper Institute, on the "Production of Animal Force," from which we extract the following:

"There are two varieties of energy—the actual or visible, as that of a falling body or of heat, and the possible, or that which is capable of doing work. A weight held in an elevated position is an illustration of the latter variety, since it represents a certain amount of potential energy. Again, our coal beds contain an enormous amount of possible energy. When this coal is burned there is produced the phenomenon of combustion, by which possible energy is converted into actual energy in the form of heat or motion. The amount of energy is fixed, and no effort of ours can produce more than a certain quantity. If this inability to trick nature into giving us more force than actually exists were more thoroughly understood, we should hear less of schemes for producing perpetual motion and Keeley motors. All our machines now are constructed to convert possible into actual energy, and this result is produced by the union of carbon and oxygen.

"Three classes of substances are necessary to constitute food—organic or mineral, such as salt, which is used, not to produce energy, but to build up waste parts; sugars, starches, and fats, the latter producing heat; and albuminoids, such as lean meats and the whites of eggs. By a large number of experiments, several members of the French Academy have proved that death will follow if one is deprived entirely of any one of these three classes. The popular distinction between food and drink is not scientifically tenable. In many articles of food, especially in vegetables, a large percentage of water is found. Milk, on the other hand, is called a drink; but it contains the three substances above referred to that are necessary to sustain life, and in exactly the right proportions. For this reason babies are enabled to live for months entirely upon this drink, which is really a food.

"The life-giving power of food must pass into the blood before it can be of use to the system. No food is useful, no poison is deleterious, no drug is efficacious, until it has passed into the blood, by the process technically called dialysis, by which the food passes through the membranes into the blood. The holes in the membranes by which this process is allowed cannot be seen with a microscope. Thirty years ago Graham discovered that dialysis could not take place unless the substance possessed the quality either of solubility or crystallization. There is much food, however, that has neither of these qualities, and the process of digestion is necessary before the substances can become a part of the blood. In digestion the chemical change is of the most importance. It was not until 1822 that the long-disputed question whether the stomach ground the food or dissolved it was settled. It was learned by the examination of a boatman in the employ of the Hudson Bay Company, a hole in whose stomach was made by the accidental discharge of his gun. It was found that food was dissolved in the stomach by an acid called pepsin. The oxygen needed to produce combustion is supplied through the lungs. The blood takes up the oxygen, while the nitrogen is thrown off by exhalation. The carbonic acid gas generated by this union is also thrown off. The heat, then, of the body is produced by the union of oxygen and hydrogen. Two French experts, Becquerel and Breguet, have shown by experiments that, as far as heat and motion are concerned, the production of energy in animals is based upon the same well-known laws as is the production of energy in outside bodies, such as machines, and their conclusion is undoubtedly correct. In a word, it is as true of a muscle as of a machine, that when it is doing work the heat that was apparent during its inactivity, either in the muscle or in the engine-room, is lessened and appears in a different form."

Pocket Microphone.—M. Trouve has invented a cylindrical microphone which resembles a small dark-lantern, with a carbon crayon substituted for the candle. It is claimed for this instrument that when placed in the middle of a room, it reveals all secrets. It transmits the voice admirably to a receiving telephone, even when the speaker stands eighty or more feet from the microphone. When a watch is placed in the interior, it seems to be making unheard of efforts to get out. The instrument can be easily used for revealing the normal or morbid movements of the heart and lungs.

We find the above in the French journal *La Nature*, but think the statement exaggerated.

The Yale Lock Manufacturing Co.,

Large enterprises often grow out of small beginnings. In illustration of this accepted fact, we may cite the case of the Yale Lock Manufacturing Co., of Stamford, Conn., who commenced business by manufacturing one or two styles of the small flat-keyed lock which has since come to be known and used all over the world. The present business of the company includes a number of distinct specialties, the principal of which are the following: 1st. House and cabinet locks, adapted

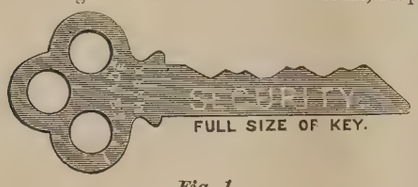


Fig. 1.

to almost every business requirement, and embracing upwards of 400 varieties, sizes, and styles. 2d. Time locks, and other bank locks. 3d. Post-office lock-boxes and equipments. 4th. Weston's differential pulley-blocks and safety hoists.

LOCKS OF VARIOUS KINDS.

Fig. 1 represents the form of key which is used with all the Yale locks. This key is now so well known that its smallness and convenience no longer attract attention; but the contrast which it presented with

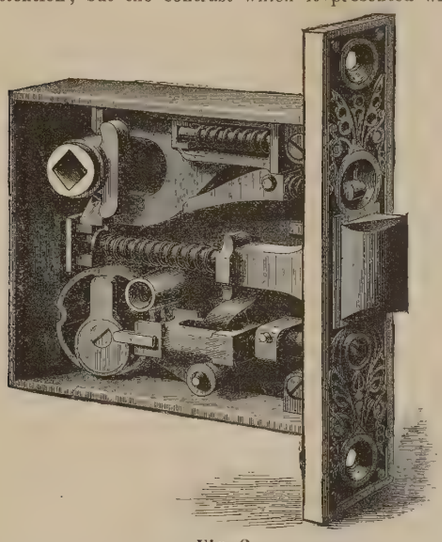


Fig. 2.

the keys in common use at the time of its introduction was startling. The rule then was that "the larger the lock the larger the key," (and, consequently the larger the key-hole, and the better the opportunity for tampering with the lock); but it is now recognized that by properly constructing the lock, the size of the key may remain constant for all sizes of locks, and that one of the size shown above may be abundantly capable of operating a lock of the heaviest construction.

Fig. 2 represents one of the Yale night-latches, with its cap removed, and indicates the general design and

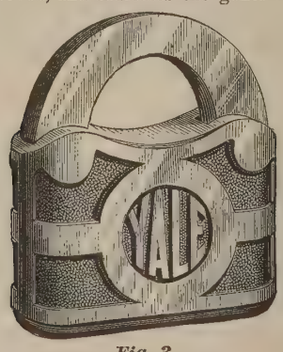


Fig. 3.

construction of this class of goods. The company also manufacture what are known as the "Standard Locks." These are a full line of door and other locks, of more simple and less expensive construction than the Yale locks, and applicable to uses where a cheaper lock is desired.

The last addition which the company have made to

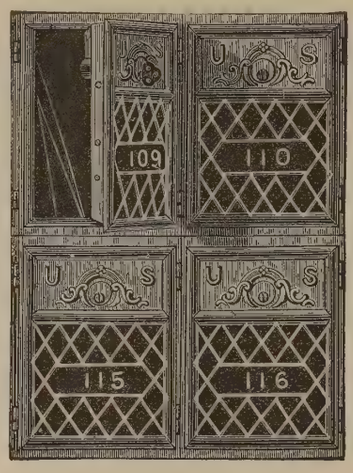


Fig. 4.

this line of goods is the pad-lock represented in Fig. 3. It is entirely of bronze or gun-metal, and is made in a

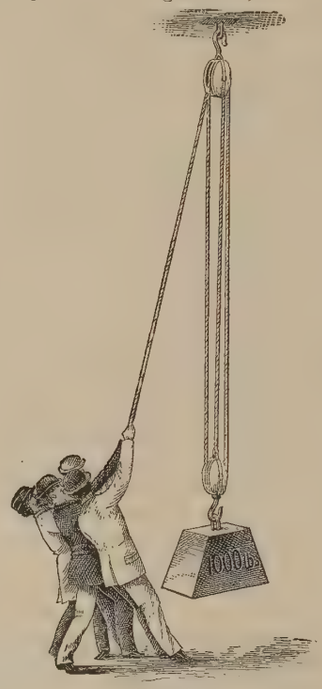


Fig. 5.

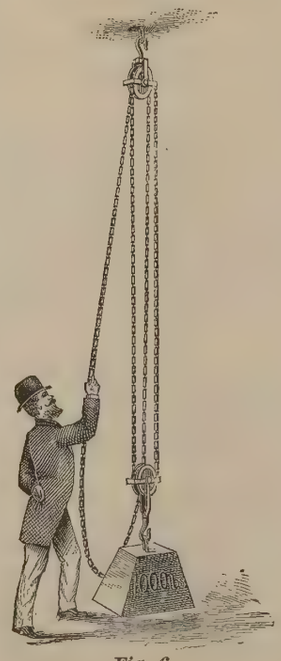


Fig. 6.

variety of sizes. The construction is one giving peculiar solidity and strength, and the lock is in every way superior to anything of the kind heretofore made.

The third specialty of the company has grown out of its manufacture of the well-known Yale post-office lock-boxes, about 100,000 of which are now in use in post-offices throughout the United States. The general construction of these boxes is so well known that

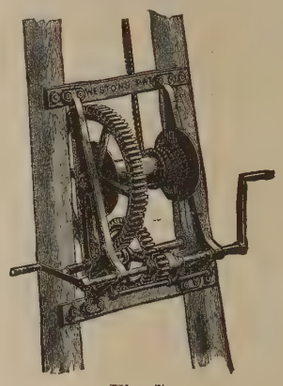


Fig. 7.

no description is needed of the accompanying cut (Fig. 4), representing a small section of them.

PULLEY BLOCKS AND SAFETY HOISTS.

The most recent specialty of the company is the Weston differential pulley-block and other forms of safety hoists. The differential pulley-block was one of the mechanical discoveries of the century, and it has gone into world-wide use among engineers. Figs. 5 6 represent, without any exaggeration, the relative ad-

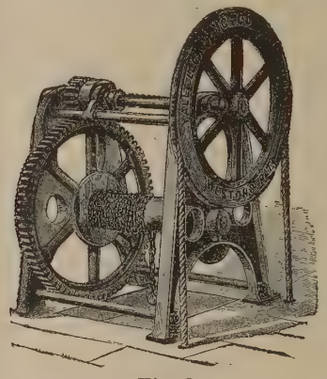


Fig. 8.

vantages of the Weston block as contrasted with the old-fashioned rope and tackle-block. Four men with the latter, can with difficulty do what one man does easily with the former. Moreover, with the Weston block the load remains always suspended at any point, and can never "run down." To lower, it is necessary to reverse the action of the block by *pulling* on the opposite side of the chain. So long as this is continued the load will descend, but if the chain be let go the load immediately comes to rest.

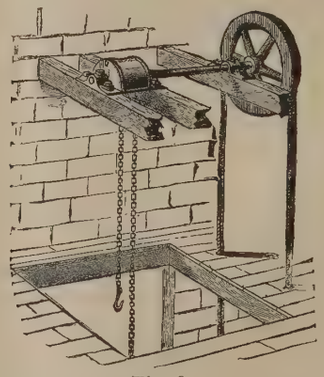


Fig. 9.

Mr. T. A. Weston, the inventor of the differential block, is also the inventor and patentee of numerous other hoisting devices, which are made and sold by this company. The illustrations (Figs. 7, 8 and 9) represent some forms of these machines, such as are

adapted to use over hatchways in stores, mills, etc., and in connection with derricks and other similar hoisting devices.

The specialty of the company in all its manufactures has always been the production of thoroughly good work, and an examination of their various products will, we believe, establish the fact that they are at least equal to anything of their kind that is produced.

Their works are located at Stamford, Conn., (thirty miles from New York), where is also the principal business office. The New York salesroom is at No. 53 Chambers street.

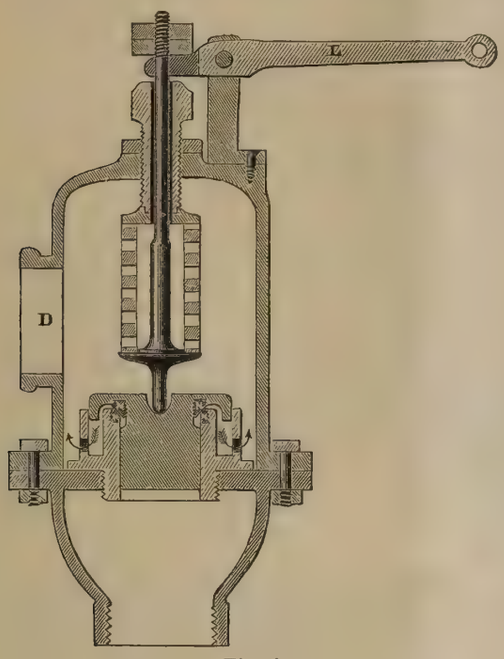


Fig. 1.

Nickel Seated Safety-Valves.

The nature of the material which has thus far been used for the bearing surfaces of safety-valves has always been a source of danger. Being a common metal, it is subject to rust or corrosion, and almost every one knows that when two metals in contact corrode, and remain in corroding contact for some time, they are very apt to stick together; hence careful engineers frequently try the safety-valves, so as to prevent this sticking together, which, while it adds its share to the weight with which the valve is always charged, may cause the pressure requisite to lift it to exceed the maximum strength of the boiler, and cause a disastrous explosion.

We ought to remark in this connection, that the time has passed for ingenious and often absurd theories of boiler explosions, such as electricity, the generation of explosive gases, of nitro-glycerin, water in the spheroid condition, instantaneous generation of immense quantities of steam, etc. All engineers of common sense now acknowledge that the cause of explosions is simply a gradually increasing and accumulating pressure of the steam, which at length reaches a degree exceeding the strength of the boiler, when it yields. If the boiler has a very weak spot this will give way first, and if it does not discharge in the furnace, but in a safe direction, the explosion may be comparatively harmless; but if the boiler is equally strong (or weak) in all its parts, so that it gives way in many directions at the same time, the danger is at its maximum.

Besides the defect of corroding safety-valves, there is another not to be lost sight of, namely, their insufficient size. It is not enough to make a hole which calculation would show to be sufficient to discharge the steam generated during the time the engine is stopped, and equal to that consumed by the engine, and then to place a valve charged by the properly calculated weight over this valve. It should not be forgotten that when the steam pressure lifts this valve, the opening cannot discharge steam at the ratio of its full aperture; the valve over it prevents this, and being loaded, reduces this aperture considerably, so that the opening should be so much larger that the space between the valve and its seat, when lifted, is sufficient to discharge all the superfluous steam. It is a common defect of safety-valves that they are too small.

The two principal defects and sources of danger referred to have been obviated by the Ashcroft patent Nickel Seated Safety-Valve, manufactured by the Consolidated Safety-Valve Co., of 51 and 53 Sudbury street, Boston, Mass. Its name indicates its security against corrosion, as nickel is as non-corrosive as gold and platinum, and much harder. The security against insufficient size is attained by the peculiar shape of the valve and its seat, which is represented in the vertical section, Fig. 1, while Fig. 2 shows its exterior appearance. The valve is brought down by a spiral spring, gauged to the proper pressure, while the lever L serves to lift it. The valve, as seen in the figure, is cylindrical, with a flat bottom, so that the pressure of the steam remains the same when it is lifted, and therefore will lift it higher and create a larger opening for the escape of the steam, than is the case with the ordinary valve.

In order to represent this graphically to our readers, we have in Figs. 3 and 4 drawn two circles of 3 inches diameter, representing the area of the opening of a safety-valve, while the interior small circle shows the size of the surface of the actual section through which the steam is allowed to escape when fully lifted. The small circle in Fig. 3 represents the section of the acting aperture of a common valve, which amounts to little more than one-third of a square inch, while Fig. 4 the corresponding circle represents the section of the acting aperture of the Ashcroft valve, which amounts to nearly 1¾ square inches, and therefore almost six times as effective.

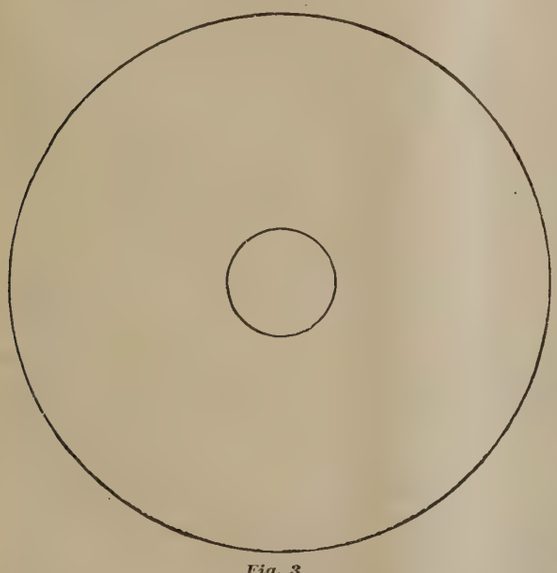


Fig. 3.

Fig. 4.

Prof. Burg, of Vienna, found by actual measurements, made by means of apparatus constructed for the purpose, that a common safety-valve of 4 inches diameter rises from its seat according to the following law:

Pressure in boiler,	12	35	50	70	90 lbs.
Lift of valve,	$\frac{1}{36}$	$\frac{1}{54}$	$\frac{1}{86}$	$\frac{1}{68}$	$\frac{1}{168}$ inches.

Other reliable authorities do not fix the rise of such a valve from its seat at more than one-32d of an inch when loaded at any pressure between 12 and 90 pounds. Further experiment by Prof. Burg proved beyond a doubt, that the higher the pressure the less will a common safety-valve rise; and, in not rising, it simply obeys the action of the forces exerted upon it.

Experiments at the Navy Yard in Washington have confirmed this. We extract from the report of Edward Fithian, Chief Engineer of the U. S. Navy, the results of measurements made there: "The 4-inch common safety-valve, when blowing off at the limit of pressure, had a lift of $\frac{1}{20}$ of an inch, giving an area for the escape of steam of only $\frac{63}{100}$ of a sq. in. The Nickel Seated Safety-Valve of the same diameter, operating with the same pressure, had a lift of ¼ of an inch, giving an area for the escape of steam of $\frac{3}{14}$ of a square inch. The 3-inch common valve had a lift of $\frac{1}{17}$ of an inch, giving an area of opening of $\frac{56}{100}$ of a square inch, while the 3-inch Nickel Seated Valve had a lift of $\frac{3}{16}$ of an inch, giving an area of opening of 1.76 square inches. In the experiment to ascertain how much the pressure could be increased while the valve was blowing off at the limit of pressure with the 4-inch common valve, which is about the diameter used on cylindrical boilers of 6 by 20 feet, the pressure was increased 5 lbs. in 4 minutes, without any apparent increase in the lift, and the experiment was stopped. With the 3-inch common safety-valve it was increased 9 lbs. in 6 minutes. The 4-inch Nickel Seated Valve operating under the same cir

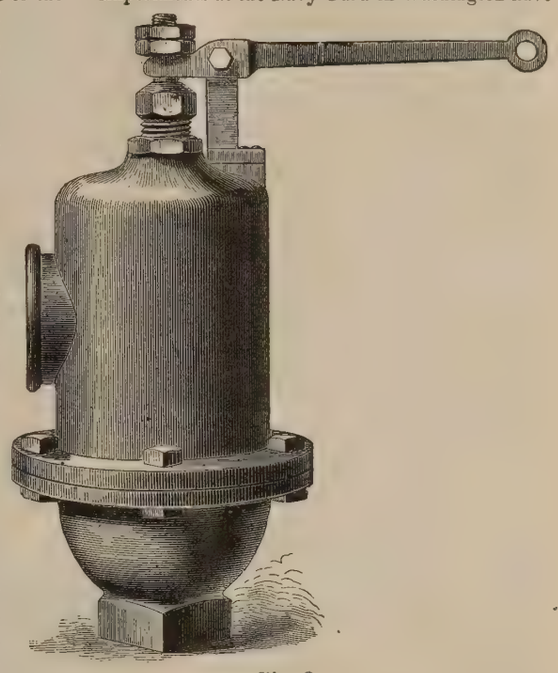


Fig. 2.

cumstances, opened to its full lift as soon as the limit of pressure was reached, and the pressure could not be increased, but it steadily decreased to a point a *little* below the original pressure, when the valve suddenly closed. With the 3-inch valve the pressure was held at its limit. In both cases the fires were in active condition, and the furnace doors closed.

"The experiment proved that the lift of the safety-valve is not sufficient, and will not increase sufficiently with the pressure by its own action, to relieve the boiler under all circumstances, and that the pressure can be increased until an explosion takes place, while the valve is in operation; and therefore it is not in reality a safety-valve. The Nickel Seated Valve, under the same conditions, obtained its full lift instantaneously by its own action, giving an opening of sufficient area to relieve the boiler at once."

Parties using these valves speak of their efficiency in the very highest terms, and we only give the names of a few of the many who have given testimonials as to their value. Among these we may mention Henry W. Sage & Co., Gates & Fay, Eddy, Avery & Co., W. H. Miller, H. M. Bradley & Co., John McGraw & Co., of Bay City, Mich.; D. H. Jerome, & Co., Saginaw, Mich.; Homer Hamilton & Co., Youngstown, O.; Dick & Church, Meadville, Pa.

The Consolidated Safety-Valve Co., the manufacturers of the above described valve, have recently acquired the patents covering the same, together with stock in trade and good will from the Ashcroft Manufacturing Co., the former owners of this valve; and have also obtained by purchase the safety-valve patents and business of Geo. W. Richardson & Co., of Troy, N. Y. Operating under these two valuable patents, the company promise that the best possible workmanship may be depended upon by all who favor them with their patronage.

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Pine, shipping box	18 00 a 22 00
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Pine, common box, ⅝	13 00 a 15 00
Pine, tally plank, 1¼, 10 inch, dressed, each	40 a 43
Pine, tally plank, 1¼, 2d quality	35 a 38
Pine, tally plank, 1¼, culls	25 a 28
Pine, tally boards, dressed, good	28 a 30
Pine, tally boards, dressed, common	22 a 25
Pine, tally boards, culls, dressed	21 a 23
Pine, strip boards, merchantable	16 a 18
Pine, strip boards, clear	22 a 25
Pine, strip plank, dressed, clear	33 a 35
Spruce boards, dressed	18 a 20
Spruce plank, 1¼-inch, dressed	22 a 25
Spruce plank, 2-inch,	28 a 34
Spruce wall strips	13 a — 15
Spruce timber, per M	16 00 a 19 00
Hemlock boards, each	14 a — 16
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Hemlock joist, 3x4	16 a — 18
Hemlock joist, 4x6	40 a — 44
Ash, good, per M	38 00 a 45 00
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Maple good	42 00 a 45 00
Chestnut	42 00 a 48 00
Cypress, 1, 1½, 2, and 2½-inch	35 00 a 40 00
Black walnut, good to choice	85 00 a100 00
Black walnut, ⅝-inch	75 00 a 85 00
Black walnut, selected and seasoned	110 00 a150 00
Black walnut counters, per ft	12½ a 20
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White wood, inch	40 00 a 50 00
White wood, ⅝-inch	30 00 a 35 00
White wood, ⅝ panels	35 00 a 40 00
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Shingles, extra shaved pine, 16-inch	8 50 a 9 50
Shingles, extra sawed pine, 18-inch	7 00 a 8 00
Shingles, clear sawed pine, 18-inch	6 50 a 7 50
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Locust posts, 10 feet	24 a 25
Locust posts, 12 feet	29 a 34
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Nominally.	Cargo.	Afloat.
Pale, per M	3 00 a —	—
Jersey	5 00 a	5 25
Long Island	5 25 a	5 50
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Haverstraw Bay	— — a —	—
" " choice	— — a —	—
Favorite Brands	— — a —	—

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Croton—Brown, per M	— — a 7 00
" Dark	— — a 8 00
" Red	— — a 9 00
Philadelphia	26 00 a 28 00
Trenton	24 00 a 29 00
Baltimore	34 00 a 38 00

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Duty.—Bar, 1 to 1½c. per lb.; Railroad, 70c. per 100 lbs.; Boiler and Plate, 1¼c. per lb.; Sheet, Band, Hoop and Scroll, 1½ to 1¾c. per lb.; Pig, $7 per ton; Polished Sheet, 3c. per lb.; Galvanized, 2½c. per lb.; Scrap Cast, $6 per ton; Scrap Wrought, $8 per ton—all less 10 per cent. No Bar Iron to pay a less duty than 35 per cent ad val.

	Store prices.	Cash.
Pig, Scotch—Coltness	21 50 a	22 50
Glengarnock	20 50 a	21 50
Eglinton	19 50 a	20 50
American, No. 1	16 50 a	18 00
American, No. 2	15 50 a	17 00
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Ba., Swedes, nail-rod	— — a —	6½

LEAD—PER 100 POUNDS.

*German	— — a — —
*English, common	— — a — —
*Spanish	— — a — —
*Foreign, refined	— — a — —
*Bar	5 00 a — —
*Sheet and Pipe	5 00 a 6 00
*Domestic	3 37 a — —

NAILS—PER KEG.

10d to 60d, common, fence and sheathing	2 30 a — —
8d and 9d, common	2 85 a — —
6d and 7d, common	3 10 a — —
4d and 5d, common	3 35 a — —
3d and 4d, light	4 10 a — —
3d, fine	4 85 a — —
2d, fine	4 85 a — —
Cut spikes, all sizes	2 85 a — —
Clinch nails, 1½ to 1¾ inch	5 00 a 5 25
do. 2 to 2¼ inch	4 75 a — —
do. 2½ to 2¾ inch	4 50 a — —
do. 3 inch and longer	4 25 a — —

TIN PLATES.—Duty, 1 1-10 cents per pound.

*I. C. charcoal, 10x14, per box	6 00 a 6 25
*I. C. coke, 10x14	5 25 a 5 75
*I. X. charcoal, 10x14	8 00 a 8 25
*I. C. charcoal, 14x20	6 00 a 6 25
*I. X. charcoal, 14x20	8 00 a 8 25
*I. C. coke, 14x20	5 00 a 5 75
*I. C. coke, terne, 14x20	5 00 a 5 12½
*I. C. charcoal, terne, 14x20	5 25 a 5 50

ZINC.—Duty, sheet, per lb., 2½ cents.

Sheet, (cask) per lb	— 6 a — 6¼
Sheet, (open)	— 6½ a — 6⅝

STONE.—Cargo Rates.

Amherst Freestone, in rough, per cubic foot	— — a — 85
Berlin Freestone, in rough	— — a — 95
Berea Freestone, in rough	— — a — 75
Brown-Stone, Portland, Conn	1 25 a 1 50
Brown Stone, Belleville, N. J	1 00 a 1 50
Granite, rough	— 60 a 1 25
Canaan Marble	1 25 a 1 50
Dorchester, N.B., Stone, rough, per foot	— — a 1 03

PAINTS.

*Carmine, American, per lb. gold	5 00 a 5 50
Chalk, per lb	— 00¼ a — 00⅜
China Clay, per ton gold	20 00 a 22 00
Chrome yellow, dry, per pound	— 12½ a — 28
Lead, red American, per pound	— 7 a — 8
Lead, white American, pure, in oil	— 7½ a — 8
Lead, white American, pure, dry	— 6¾ a — 7¼
Lead, white English, pure, in oil gold	— 10 a — 10½
Litharge	— 7 a — 8
*Ochre, Fr., dry, per 100 lbs	1 50 a — —
Ochre, ground, in oil, per lb	— 6 a — 15
Ochre, Vermont, per 100 lbs	— 75 a 1 00
*Orange Mineral, English gold	— 9½ a — 10
Paris White, American	— 1¼ a — 1½
Paris White, English, prime	— 1¾ a — 2
Paris Green	— 15 a — 28
Plumbago paint, patent, per lb	— — a — 25
Putty, per lb	— 1¾ a — 2½
Spanish Brown, dry, per lb	— 1⅛ a — 1¼
Spanish Brown, ground in oil, per lb	— 8 a — 9
Venetian red, per cwt	1 75 a 2 00
*Vermilion, Chinese, per lb	— 80 a — 90
*Vermilion, Trieste	— 70 a — 80
*Vermilion, quicksilver, bags gold	— 55 a — 57½
Vermilion, American, common	— 15 a — 18
Whiting, per 100 lbs	— 40 a — 75
Zinc, white American, dry, No. 1	— 6½ a — 7½
Zinc, white American, No. 1, in oil	— 8 a — 10
*Zinc, white French, dry, (Red Seal,) gold	— 8 a — 8¼
Zinc, white French, in oil gold	— 10 a — 10½

VARNISHES—PER GALLON.

American Wearing Body	3 50 a 4 00
Coach Body	2 35 a 3 50
do do	1 80 a 2 00
Furniture	1 25 a 2 50
Black Asphaltum	1 00 a 1 50
Brown Japan	1 00 a 1 20
Liquid Paint Dryer	1 35 a 1 75
Harness, (black)	3 00 a 4 50
Shellac, Spirits	3 00 a 3 50

CEMENT—PER BARREL.

Portland (imported)	2 75 a 3 25
Portland (American)	2 50 a 2 90
Roman	2 80 a 3 25
Keene's, coarse	6 50 a 7 00
" fine	10 00 a 10 50
Martin's, coarse	6 00 a 6 50
" fine	10 00 a 10 50
Rosendale	1 00 a — —

DEADENING AND ROOFING MATERIAL.

Mineral Wool for Roofs and Deadening, per lb. — 1¼ a — 1½

HAIR.

Cattle, per bushel of 7 lbs	— — a 9 12½
Goat, " "	— 15 a — —

SLATE.

Purple roofing slate, per square	$6 00 a 7 00
Green slate	6 00 a 7 00
Red slate	10 00 a 11 00
Black slate, Pennsylvania	5 00 a 5 25
Slate tiles, 1¼-inch, rubbed, per square foot	20 a — 25

SOLDERS.

No. 1	— 10½ a — 11
No. 2	— 8½ a — 9¼

PLASTER PARIS.

Duty.—20 per cent ad. val. on calcined; lump free.

Nova Scotia, white, per ton	2 80 a — —
Nova Scotia, blue	2 75 a 2 80
Calcined, Eastern and city, per bbl	1 00 a 1 10
Calcined, city casting	1 15 a 1 25
Calcined, city superfine	1 25 a 1 50

LIME—PER BARREL.

State, common	— 80 a — —
" finishing	— 90 a — —
Rockland, common	— 75 a — —
" finishing	— 90 a — —
Ground	— 80 a — —

Add 25 cents to above figures for yard rates.

FOREIGN WOODS.

MAHOGANY.

St. Domingo, crotches, ordinary to good, per ft	— 15 a — 20
St. Domingo, crotches, fine	— 20 a — 30
St. Domingo, logs, small	— 5 a — 8
St. Domingo, logs, large	— 8½ a — 14
Frontera, Mexican, large	— 9 a — 12½
Frontera, Mexican, small	— 6 a — 8
Other Mexican	— 6 a — 12½
Honduras	— 6 a — 12½

ROSEWOOD.

Rio Janeiro, ordinary to good, per lb	— 2 a — 3½
Rio Janeiro, good to fine	— 4 a — 8
Bahia, ordinary to good	— 1¾ a — 3
Bahia, good to fine	— 3 a — 7
Honduras, per ton	10 00 a 20 00
Satin Wood, per foot	— 15 a — 25
Tulipwood, per lb	— 6 a — 7
Lignumvitæ, small, per ton	10 00 a 20 00
Lignumvitæ, large	25 00 a 50 00

DRAIN AND SEWER PIPE.

(Delivered on board at New York.)

PIPE, per running foot.

2 inches diameter,	$0 13	10 inches diameter,			$0 70
3 "	0 16	12	"		0 80
4 "	0 20	15	"		1 25
5 "	0 25	18	"		1 60
6 "	0 30	20	"		2 00
7 "	0 35	22	"		2 50
8 "	0 45	24	"		3 00
9 "	0 55				

General Review of the Markets.—The markets have worked in a little better shape the past month, and prices have strengthened in many cases. The volume of trade has been fair with the probability of an increase during the present month. We hear of many buildings in contemplation up town, owners now seeing an opportunity of making property hitherto unproductive, remunerative, through the facilities offered by rapid transit. The outlook, altogether, for a good spring trade seems cheering, and we hope to record in our April report a marked improvement.

The Markets in Detail.—In the lumber market the past month demand has increased to some extent, and dealers seem hopeful, looking to a greatly improved condition of trade during the year. Prices have remained steady but not buoyant.

In the brick market the consumption of common hards was up to the average reported during the season, and in the wholesale market demand may be said to have exceeded the supply as the principal points have been still shut off from all communication. The combination to maintain prices has been making progress, and the probabilities are that it will succeed. If so it will result in benefit to all, as at present manufacturers are producing at a loss.

In the lime market business has worked into better and more hopeful shape with prices strengthening.

In the lath market there has been a firmer tone with the advantages on the side of the selling interest. Business has been restricted by small offerings, but buyers have been inquiring for stock, a few parcels of which could have been placed at full former figures.

In the cement market Rosendale has been firm with demand good, and supplies diminishing. Foreign has shown irregularity, but cost has remained about the same.

In the hardware market demand has been up to about the average, and, if anything, has tended to an increase.

In the paint market a very fair business has been doing in a jobbing way, and the indications seem favorable for a still further increase on the principal stocks.

In the metal markets American pig iron has shown increasing firmness; manufactured iron has been slow of sale; Scotch pig has remained pretty steady with a fair average business doing. Domestic pig lead has found only a moderate and somewhat uncertain demand. Tin in pig has been firmer; tin-plates have been running out to a fair extent and ruling steady on most kinds.

Home Department.

Improved Seats and Desks for School-Rooms.

In our excellent system of popular education there has thus far been no greater improvement in any department than in the method of furnishing our schools. The primitive seats with which many, even of the present generation, are familiar, consisted sometimes of a plain, unpainted board, but oftener of a slab from the side of a saw-log, with the flat side up, and with the rough legs sticking up through it, with no support whatever for the back. In place of that we now have desks and seats made in the best style of the cabinet-maker's art, in which the greatest care is exercised to have them of a shape to give the pupil a healthy and comfortable position while studying; they are neat and tasty in appearance, and thus assist in rendering the school-room cheerful and attractive; they are at the same time strong and durable, able to withstand the rough usage to which they are often subjected; and last, though not least, they are produced at a price which will enable schools of every kind to possess them.

Among those who have given much labor and study to this branch of business is the Buffalo Hardware Company, of Buffalo, N. Y., who commenced the manufacture of school desks some five years ago, having at that time absorbed another concern which had been established for eight years before. Their "Paragon" desk has, during the past five years, achieved an enviable reputation by reason of its many good qualities, and has been introduced into many of the best schools in all the States, from Maine to Kansas. But not content with "well enough," the company have, after much study, labor, and expense, brought out for the season of 1879 the "New Paragon" desk, an engraving of which we represent on this page, and which they claim will eclipse everything else in the school desk line. They have bestowed more labor and expense upon the patterns for the various sizes than were ever put upon similar objects before. No pains have been spared to make the desk faultless in shape, appearance, and workmanship.

"NEW PARAGON" DESK.

As it is customary to ship this class of furniture in "knock down" form, to save freight, much pains have been taken to produce a desk that can be easily and quickly put together by any inexperienced person. This has been accomplished by a combination of the dove-tail and screws in fastening the wood-work to the iron standards, thus giving it the advantage of a double fastening, and rendering it a very easy matter for any one to set up the desks. The slats of the back and seat are glued up into one piece with a double tongue and groove joint, the edges being bevelled to bring them to the right curve. This is far better than the loose slats with open joints commonly used. The castings are of unusual weight and strength, and in design exceedingly neat and graceful. The seat is made to fold up out of the way when not in use, and special pains have been taken to make a seat arm, and hinge joint which cannot be broken or worn out, and which will be noiseless. Nearly every part of the work upon these desks is done by machinery which has been specially designed and constructed for the purpose, and which does its work with the greatest possible economy and despatch. The castings for these desks are all made in the extensive foundry of the company, a guarantee that this important part of the desk is of the best material and workmanship.

We would recommend all who are in want of school desks to write to this company for descriptive circulars, prices, and terms before making their purchases.

Character in Business.

The difference of character is never more distinctly seen than in times when men are surrounded by difficulties and misfortunes. There are some who, when disappointed by the failure of a business undertaking, from which they had expected great things, make up their minds at once to exert themselves no longer against what they call fate, as if thereby they could avenge themselves upon fate; others grow despondant and hopeless; but a third class of men will rouse themselves just at such moments and say to themselves, "the more difficult it is to attain my ends, the more honorable it will be;" and this is a maxim which every one should impress upon himself as a law. Some of these who are guided by it prosecute their plans with obstinacy, and so perish; others, who are more practical men, if they have failed in one way, will try another.

Shall We Continue to Poison Ourselves?

The heading to this article is the question of the hour. Adulteration in food products, poisonous dyes in articles of wearing apparel, poisonous paints and wall papers surrounding us, tend to injure and shorten life. Against these evils fight is being made by State health associations, physicians and sanitary reformers and with some measure of success.

We propose to present in this article the damage resulting from the use of poisonous paints, and more especially of carbonate of lead familiarly known as white lead, the base of most paints in use. During 1878 at the Portsmouth dockyard seventy-five serious cases of lead poisoning occurred, and there was a similar outbreak at the Devonport dockyard a short time before.

It arose from the workmen breathing minute lead particles, that had become diffused through the surrounding air. This lead-impregnated atmosphere formed a poison of a highly insidious character. At the Sanitary Congress held at Stafford, England, and also at the Social Science meeting, Dr. H. C. Bartlett presented some startling statistics which were sufficient to induce the recommendation by Dr. Phepson and other sanitary authorities and practical men of the new silicate white paint as a complete substitute for white lead. This paint is non-poisonous, it does not discolor in the fumes of sewer-gas or sulphuretted hydrogen, and as it does not blister or chalk it possesses desirable features. It has good body, and is really cheaper to use than lead paint, as it covers 25 per cent. more, and it is claimed that as a primer it is superior to other compositions. The various foreign governments endorse and use it, and throughout the United States it gives satisfaction.

The perfect neutral action upon metal renders it the best possible preservative of iron, and for ships bottoms, masts and yards as well as the iron fronts of buildings it is a good coating as it prevents corrosion or decay. We have been shown by Mr Howard Fleming of 10 Pine street, New York, who controls the sale of this paint, samples of the raw material and of the paint ground in oil, and it surpasses lead and zinc in the purity of the white. As this new silicate white paint becomes more widely known it is preferred to other compositions which have tended to create distrust and prejudice against new inventions. This new article is so well endorsed that it is worthy of confidence.

Keep Dwellings Dry.

Says the *Cincinnati Artisan:* "A warm and dry atmosphere is not unwholesome, but when cloudy or rainy weather brings a sultry air which dampens everything around us, the atmosphere may be loaded with the germs of disease, and fire is needed to destroy them. The walls, the ceilings and the floors of apartments should never be allowed to become damp. Sometimes, when the warmth of the air is oppressive, fire is more necessary to preserve health than it is at another season to protect us from the cold of winter; and the rooms of a dwelling should never be left without the means of warming and drying. Investigations have shown that many of the most fatal diseases are caused by the germs of vegetable and animal life, and that a humid atmosphere is most favorable for their propagation. It is, therefore, neglecting to avail ourselves of the great discoveries of the age, and failing to protect ourselves from scourges which so fearfully afflict families, when we ignore the dangers which surround us. Apartments exposed to the full action of the sun may be less comfortable in hot weather than those from which the sun's rays are excluded, but they are more wholesome, and when contagious diseases prevail in closely-built cities it is found that the inmates of houses on that side of the street exposed to the sun are less liable to be attacked, while the greatest number of sick are always found where there is the least exposure to the rays of that great disinfector—the sun.

Alum in Bread.—Alum is sometimes used by bakers to make a good-looking loaf from an inferior quality of flour. The danger of using it freely has often been adverted to, and we notice that an eminent English medical authority says that the general use of alum by bakers is one of the most fertile causes of dyspepsia, liver and bowel complaints in adults, and of debility and rickets in children. Bad teeth and their early decay is another consequence of the daily use of alum in food. It is claimed by physiologists that when there is alum in flour, the bone matter of the bread (phosphate of lime) instead of becoming assimilated by the system, is either wholly or in part converted into a salt of alumina, which is useless and incapable of appropriation.

Usefulness of Asbestos.

We call attention to the multifarious uses that the H. W. Johns M'f'g Co., of 87 Maiden Lane, New York, make of that wonderful fire-proof and highly useful substance —Asbestos. They manufacture asbestos liquid paints in various colors and shades, such as are most durable for buildings—more durable and at the same time cheaper than other paints. Very naturally their use is daily increasing. They make an asbestos roof paint, especially intended to withstand atmospheric influences, which of course act more on a roof than on any other part of a building. They make an asbestos fire-proof paint, intended to protect wooden structures from the danger of ignition. They make asbestos roofing, with a fire-proof coating, at half the price of a tin roof. They make asbestos steam-pipe and boiler coverings, which, from the fact that asbestos is a very bad conductor of heat, economize more fuel than most other coverings; and finally they make asbestos steam-packing, round, flat, and loose; asbestos sheathings, coatings, cements, cloth, gloves, thread, etc.

In regard to practical experience with the asbestos liquid paints, Mr. W. B. Adams, one of the most extensive contractors and decorators in this city, says he has used nearly 50,000 gallons of them, and after an experience of twenty years with white lead and other paints, he considers them not only "superior in richness of color and durability, but owing to their wonderful covering properties, they are fully 20 per cent more economical than any others."

These paints have been adopted for the interior and exterior wood, iron, and stone work of the United States Capitol at Washington. Nearly five acres of wood-work in the two immense dry goods stores of A. T. Stewart & Co., of this city, are protected with the asbestos fire-proof paints.

In regard to the use of asbestos for roofing, Messrs. T. Kingsford & Sons, of the extensive Oswego (N. Y.) Starch Factory, say that they have several acres of asbestos roofing on their buildings; the first roof put on fifteen years ago is in good condition, and they prefer it to any other.

While in regard to asbestos covering for steam-pipes, Dr. Egbert Guernsey, one of the trustees of the Homœopathic Asylum for the Insane, at Middletown, N. Y., says that within the past year they have saved nearly 200 tons of coal at that institution by the use of asbestos pipe coverings.

A similar testimonial is given by M. C. Foot, Chief Engineer of the Ophir Mine, Nevada, stating that it costs only half as much as other coverings, while an unskilled workman can easily apply it.

It is indeed surprising to see how a substance, formerly neglected and considered as a mere mineral curiosity, has entered upon so useful a career, and this by the ingenuity and perseverance of Mr. H. W. Johns, the inventor of all the various materials manufactured and sold by this company.

Miscellaneous and Advertising.

Latest and best books on steam-engineering. Send stamp for catalogue, F. Keppy, Bridgeport, Conn.

NICKEL-PLATING.—Wenzel's patent perforated carbon box anode for holding grain nickel. A. C. Wenzel, 114 Center street, New York city.

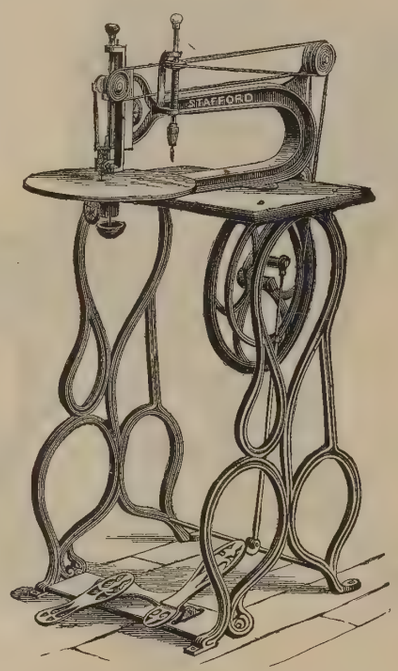
If you desire machine tools, new or second-hand, address the George Place Machinery Agency, 121 Chambers street, New York.

The great decline which has taken place in the price of iron, has resulted in the more extensive use of this material in the erection of buildings, and it is only surprising that so many still employ wooden beams and girders when wrought-iron can be bought at a very slight increase in cost, which is more than compensated for by the greater strength, durability, and fire-proof qualities of the latter over wood. Of those making a specialty of the manufacture of wrought-iron beams and girders are Messrs. Carnegie Bros. & Co., of Pittsburgh, Pa., who will be glad to furnish estimates, etc., on application.

Improved Scroll-Saw.

One of the defects of existing scroll-saws, and one which has annoyed many who have occupied themselves with making fancy work with the saw, is the loss of time in being compelled to pass the end of the saw through the wood, fasten it, and then unfasten and pass it out again, after each opening is finished.

This defect has been corrected by Mr. Nelson Stafford, of 66 Fulton street, New York, who has invented and patented the saw represented in the adjoined engraving. He accomplishes this by obviating any fastening at the lower end of the saw, and by causing it to work in slots, both above and below the table, which are just deep enough to embrace the back without injury to the teeth. The section necessary for the stroke is also confined in the slot, leaving only the short part of the blade, which makes the cut, unsupported. The



SCROLL-SAW.

saw clamp is reciprocated on the lower end of a sliding bar. The frame (which has the foot attached) is raised from the table enough to allow the wood to pass under and fastened in that position. The saw is passed down from the top, in the guide slot, and clamped; it is then ready for operation, and need not be unfastened again until necessary to change the blade. There is a cup which prevents the sawdust falling on the clothing, and a blower which removes the dust from the work. The machine will hold saws of different sizes. Owing to the saw being coned in slots it has no swaying or "wabbling" motion, and it being so easy to lift the point of the saw, and insert again, sharp angles can be made by a succession of short cuts, and the necessity of backing up long distances, or frequent turning sharp corners, is avoided, while it runs easily and with very little noise.

An additional improvement is that it is provided with a drill, as shown in the figure, intended to drill the holes in the pattern, after which the hole is placed directly under the saw and its point passed through, and also through the slot in the table. This drill can also be used for routing, and thus this scroll-saw used as a very different machine, which, by substituting a routing tool for the drill in the chuck, routing such as done by pattern-makers, wood-engravers, etc., can be very nicely accomplished.

The No. 2 machine, as here represented, will swing 18 inches between saw and frame, has a 12-inch iron tilting table, and costs, complete, with drill, saws, nippers, wrench, etc., $20. A larger machine, which will swing 24 inches, to be run by steam, costs $50; this has no legs attached, but is adapted for setting on a bench or stand.

The manufacturer will dispose of State rights to make these machines, subject to a royalty. For full particulars address as above.

Summer Residence.

On the opposite page we give plans and perspective views of a cottage designed by Mr. Wm. H. Beers, architect, 319 Broadway, New York. The aim has been to design a house which should have accommodation for a small family for the summer months with the least possible cost; and it may be adapted for winter use by the addition of a brick foundation.

As it has become necessary for the health of our families to be out of town at least during two or three months in the summer it will be conceded that a compact well considered and comfortable home, at low cost, is a matter of prime necessity, and we believe the plan we now offer includes all of these requisites. For the want of these small houses many families go to our summer hotels, where they pay in one season enough to build a cottage, not to speak of the discomfort of being confined in small hot and badly ventilated rooms and obliged to appear at dinner in full dress with the thermometer at 98° or 100°. Returning at the end of season, it is not surprising that most sensible people vote all country summer life a nuisance and a bore.

The cottage here illustrated stands upon wooden posts driven into the ground, is cased up to the water-table, and excavated for a cellar under the kitchen only. There is but one chimney, which, however, allows of an open fire-place in the parlor and a flue for a kitchen stove. The piazza which runs part of the way across the front of the house is an attractive feature.

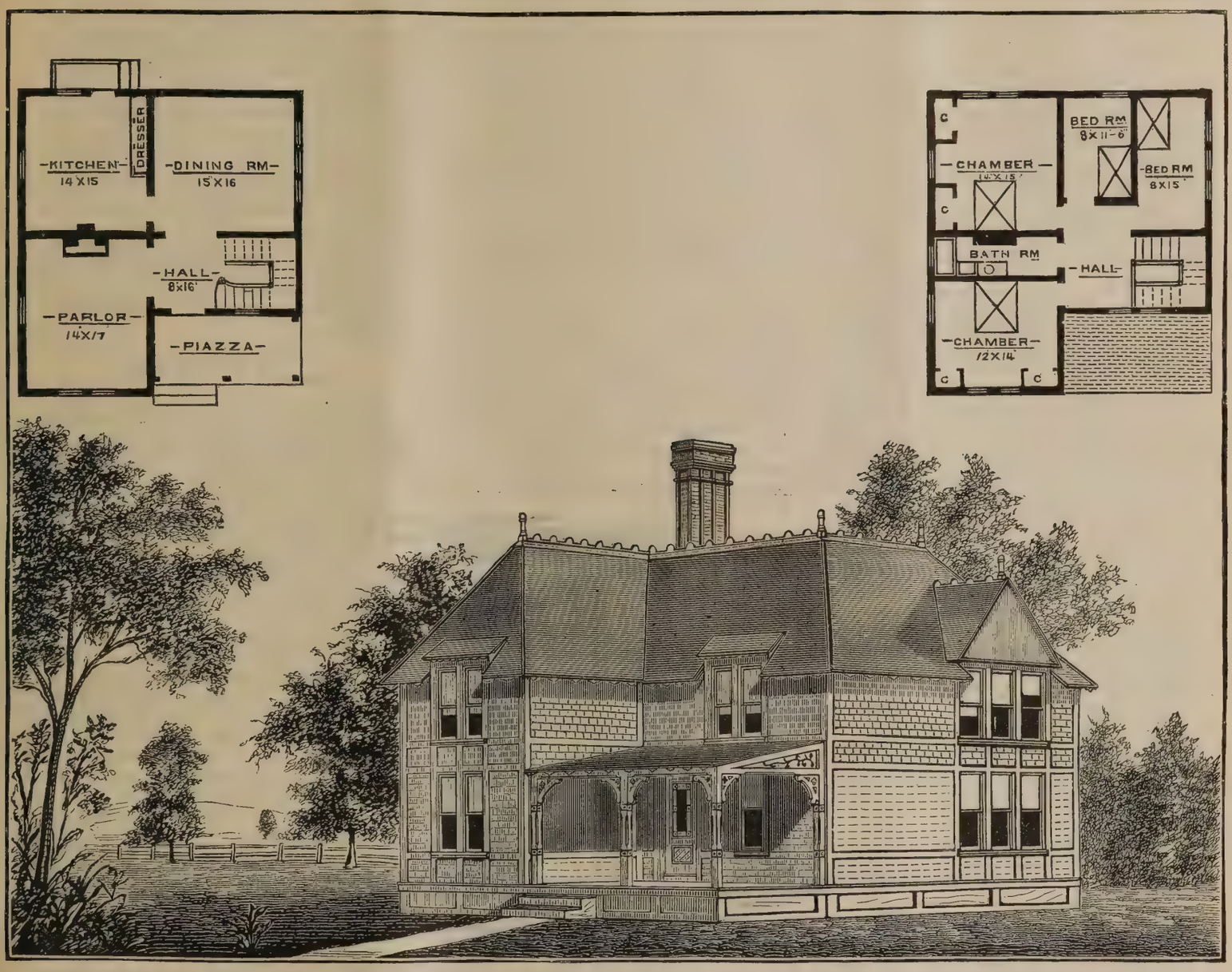
This house can be built in the vicinity of New York as directed in the specification exclusive of plumbing for $1,000.

Complete working drawings will be furnished by us to parties desiring the same for $35.

SPECIFICATION.

Hights.—Cellar to be 7 feet high to first floor beams; first story, 10 feet high in the clear; second story, 9 feet high in the clear; first story level, 2 feet above finished grade. *Excavating.*—Do all excavating required for the work in all its parts, fill in again, and make surface good. Owner will do all grading. Build the walls in best manner, 12 inches thick, of good building stone, in mortar, laid neatly, and continued above grade with good hard brick, 2 feet wide. In this wall build cellar outside door and two cellar windows, the door 3½ feet wide and as high as possible, and the windows 15 inches by 2 feet; blue stone sills to both. Also build cellar steps and checks or walls around the same; blue stone steps; walls same as cellar walls. In cellar build a cross wall of 8-inch brick under main partition; have one arch in it. Also build two 12-inch brick piers in cellar. Cellar under kitchen only. *Chimney.*—Start the chimney on a good foundation, carry up plumb, and top out neatly; parge the flues, and make fire-safe when running near any wood-work, by plastering on outside. Build chimney in parlor for stove, and also in kitchen. The fire-place to have a slate hearth. *Plaster.*—In first and second stories throughout, plaster with two good coats on good lath, in best manner, and finish with coat of best hard finish. Ram down cellar bottom and leave all smooth; to be cemented in thick with the best Rosendale cement and good sand. *Cess-pool.*—Build where directed on lot two dry, rubble-stone cess-pools, in best manner; build in all drain-pipes from house, and overflow from cistern, these pipes to be 6 inches in diameter; cess-pool 8 feet in diameter and 8 feet deep; have man-hole, cover, fastenings, etc. *Cistern.*—Also build a rain-water cistern in best manner, of brick, dome over, and make complete, with man-hole, etc.; cistern to be 12 feet deep, 8 feet in diameter, and 8-inch bottom; all plastered inside with cement and made perfectly tight; furnish and build in 6-inch drain-pipes from foot of house-leaders; have good slant.

Carpentry-Work.—All carpentry-work may be plain, but it must be neat and strong in every part. *Frame.*—The frame, unless otherwise specified, to be of sound spruce timber, well framed and put together, and thoroughly braced. Sizes as follows: Sills, 4x6 inches; posts, 4x6 inches; girths, 4x7 inches; plates, 4x6 inches, braced at angles and nailed to attic beams and rafters; braces, 4x6 inches; rafters, 2x7 inches, and 24 inches from centers; ridge-piece to ridge; floor beams, 2x10 inches in first and second stories, 16 inches from centers, and cross-bridged between supports; ceiling joists in third story, 2x6 inches, spiked to rafters; trimmers and headers, 3x10 inches; studding (hemlock), 3x4 inches, 16 inches from cen-



DESIGN FOR SUMMER RESIDENCE, COSTING $1,000.

ters, and bridged, double at all openings; partition-heads to every partition; floor beams rest on them. *Covering.*—Cover roof with hemlock boarding, well nailed. The walls under same to be covered with the very best quality pine clapboards, neatly fitted, 4½ inches weathering; and roof to be covered with sawed cedar shingles, with 5-inch weathering; have roll on ridge hips of roof. All outside finish to be of good pine stock, put up in best manner. *Finish.*—Eave moldings, belt courses, water-table, etc., to be all as shown on drawings, and carefully put up. The eaves to have a gutter sunk in top near the edge, in best manner. Plain moldings on edge and neat cantilevers underneath, every 2 feet apart, as shown. Corner-boards as shown on engraving. *Veranda.*—Veranda also as shown; 6-inch boxed and chamferred posts and plate, 3x5-inch rafters, 3x8-inch sill and cross pieces, and 2x8-inch joists; 1¼-inch narrow flooring; rafters planed and chamfered. Brackets, steps, etc., all as per drawings, and in best manner. *Gables.*—Gables to have verge board, etc.; all to be put up in neatest manner. Turned wooden finial at each gable. Plain 4-inch window-sills to all windows. Window outside casings as shown. Any other outside finish not described, but necessary to finish job satisfactorily, is to be done and finished neatly.

Inside Work.—Set all stud partitions shown, and do all furring required by the work. Frame for scuttle in roof where directed by owner. Make scuttle curb and cover of plank; cover with tin; make movable, and fit with proper fastenings complete. Make step-ladder by which to reach it. *Floors.*—Floors in kitchen to be of narrow Southern pine floor-plank, tongued and grooved and 3 inches wide; blind nailed in best manner. Veranda of white pine. The floor in attic to be rough hemlock, tacked down. In all other parts of the house the floors are to be of white pine plank, 1 inch, tongued and grooved, blind nailed, and not over 4½ inches wide in any part. Put saddles to all doors. *Stairs.*—Stairs 2 feet 10 inches wide, and 10-inch treads, in best, strongest, and neatest manner; 6-inch turned walnut post at bottom, and turned walnut balusters; 3x4-inch walnut rail, all in best manner; nosing and molding on edge of step. Cellar stairs under main flight, made strong but plain. Upper stairs plastered underneath, all neat and complete. *Trimmings.*—All inside finish to be of best clear white pine. Architraves in first story main house to be 4 inches wide, with plain moldings; in all the rest of the house 4 inches wide, with same moldings. The base may be 9½ inches high, with neat moldings throughout house. *Windows.*—Windows to be constructed as follows: Those in cellar to be made to swing; three lights of ordinary glass in strong frames; sash 1½ inches thick; good fixtures and fastenings complete. All windows 1x1½ inch thick; to have eight panes of single thick French first quality glass; hard wood sills, and best French window fixtures and fastenings, fitted up in first-class manner; 1¾-inch sash. *Doors.*—Doors as shown, with sizes given on drawings. Outside cellar door made inclined, and hung to heavy frame of seasoned chestnut. Door battened and made perfectly tight, with fastenings complete. Front door hung in halves; 2 inches thick, and to be fitted with all usual fixtures and fastenings in best manner; white porcelain trimmings. All other doors in house to be four-panelled and molded. The closet doors may be single faced and have rim locks, but all others must be double faced and have rim locks; all to have porcelain trimmings; all other fixtures to be the best make and style. Closet doors 1¼ inches thick, all others 1½ inches. *Fittings.*—In kitchen fit up a 5-foot dresser, 6 feet high and 16 inches deep, with cupboard doors below and open shelves above. Case around sink in usual manner, and 3 feet high behind it against the wall. In pantry fit up shelving, as shown in drawings. In second story fit up the hall room as a large linen closet with 14-inch shelving on two sides, as directed in drawings, all strong and neat; three drawers in this closet. In bath-room fit up in neatest manner a tub, bowl and water-closet; use black walnut and yellow pine; put door in front of bowl, and case up 2 feet behind tub. Case all pipes that show in neatest manner. Build tank in attic as directed. Fit up a bell from front door to kitchen, and also from chamber (as directed by owner) to kitchen; have copper concealed wire connections, in best manner. *Tinning.*—Do all tinning and flashing necessary to make the roof, etc., tight. The contractor must warrant this. Line gutters in careful manner, and empty at ends in 3½ inch galvanized iron leaders, to take water to leaders in ground; good connections.

Plumbing.—The plumbing in this work is to be first-class in every respect, and is to include all fixtures, etc., complete, and in good working order. Plumber to put in his work at such times as the work may demand. Put up a force and lift pump to draw water from cistern and force into the tank. *Boiler.*—Furnish and fit up in kitchen a 40-gallon tinned and planished boiler on stand, in best manner and with all usual appliances; make all connections complete. *Sink.*—Fit up a 24x36-inch cast-iron sink on iron legs; furnish with hot and cold water in most complete manner; to have brass cocks, plug-chain, trap-waste, etc. *Trays.*—The wash trays are to be supplied with hot and cold water in usual way; brass finished cocks, waste overflow, plugs, etc., all complete; trap waste. *Tub.*—Bath-tub to be 4½ feet long, lined with 14-ounce copper; to have plated cocks, plug-chain, etc.; waste to be trapped in best manner. Connect with soil-pipe. *Water-Closet.*—Water-closet to be plain cast-iron, with a cock at side; to be fitted up in best manner, complete and in best working order. Supply with water, and have 4½-inch soil-pipe, properly trapped. *Bowl.*—Wash-bowl 14 inches in diameter, marbled, in slab 1¼ inches thick; supply with hot and cold water; plated cocks, plug-chain, etc.; waste trapped in best manner; connect with soil-pipe; 10-inch marble back. *Tank.*—Line tank with 5-pound lead in best manner; solder and button well; fire-cock, overflow, tell-tale, and circulating pipe all complete. Tank to be 3 feet wide, 3 feet deep, and 7 feet long. Arrange suction-pipe to soil-pipe to prevent its being sucked dry. Pipes from cistern to cellar, with stop-cock.

Improved Fodder-Mill.

No farmer now-a-days any longer doubts the economy of grinding the coarse fodder with which he feeds his stock. Experience has shown that it produces a saving of some 40 per cent, so that 60 pounds of well ground fodder will go as far as 100 pounds of coarse unground. The consequence of this is that well-informed farmers who make stock-raising an object, want a mill in close proximity, or, what is better, a good mill on their own premises. This created a demand for such mills, and consequently a large demand for a simple, compact, reliable, and effective mill of this class has led to many attempts on the part of various manufacturers to attain the greatest possible perfection in the principles and construction of corn and feed mills. The majority of these manufactures have, however, fallen into the error of attempting to cheapen the cost of their mills by the adoption of an inferior material from which to construct the grinding surfaces, such as esopus granite, etc., and frequently iron. Those who have had experience with iron mills justly condemn them as unfit for the purpose, in consequence of their frequent breakage, wearing out, failing to grind, and partially chopping the grain as soon as their grinding surfaces become in the least worn.

The fact is that buhr is the only substance fitted for grinding purposes, and is always recommended as the best, except by those interested in selling inferior grinders. Experience with the various kinds of mills in use for years has shown that a properly constructed mill with buhrstone grinding surfaces is good for twenty years or more, and will always command a good price long after the others are worn out and thrown aside. This is a most important fact, worthy of being considered by all who wish to practice true economy, and hence would rather pay a little more at first for an article of lasting value than to buy a low-priced one which will soon have to be thrown away, and therefore is dear in the end.

A good and reliable corn and feed mill, working with buhrstone, is represented in the adjoined engraving, with the bed or non-runner stone taken off, so as to show the face of the runner stone. It is now extensively manufactured and sold by the Nordyke & Marmon Co., of Indianapolis, Ind. Although this machine has always, from its first introduction to the public, taken and held the lead over all other styles in general use, the recent improvements adopted and added to it within the last two years, combine to make it the best paying investment that any one wanting a cheap and at the same time effective mill, can put money into.

In its construction the mill is simple and complete in itself, and can be set in operation and put to work without the aid of an experienced mechanic. A boy can operate, keep in good order, and easily make good meal with it. The manufacturers have not been sparing in any particular as regards the material and workmanship necessary to make each and every part firm and durable. The principal objections to most mills of this class arise from the fact that they are usually put in soft wood frames, with castings of frail dimensions, and in consequence the spindle and other important parts soon get out of place.

This mill may be briefly described as follows: It has a horizontal steel spindle which revolves in anti-friction metal bearings, and has a steel seat at its end to receive the pressure of the buhrs in grinding. The runner is placed on an iron back and firmly attached to the spindle. The bed-stone is so arranged and constructed as to be self-adjusting; the mill therefore cannot get out of tram. The bed-stone is held up to its place in grinding by a stiff rubber spring, which enables it to yield in case any hard substance enters between the buhrs, thus obviating the danger of injuring the mill, and yet not permitting the stones to yield or press apart in grinding the ordinary substances for which they are intended. Large openings are provided for receiving the grain and discharging the meal, which cannot therefore clog or choke in its passage through. The grain is fed from the shoe directly into the spiral centrifugal feeder, by which it is distributed evenly between the buhrstones, up, down, and all sides alike. The simple and substantial manner of hanging the stones permit of their being easily taken apart for dressing, which is a most decided advantage. The spindle being horizontal, permits of the mill being driven directly from an engine, horse-power, or line shaft, which is a great advantage in most cases; and another peculiar feature and item of superiority lies in the fact that whether a strong or light power is used the mill will grind a quantity in proportion, and still do a superior quality of work.

The mills are at present manufactured of two sizes, the smaller size being especially adapted for use with any kind of light power, and for farm and plantation work, for which purpose it has been extensively introduced and adopted, always giving the best results and satisfaction. It will also make good, merchantable or family meal, grind wheat, middlings, or minerals, and all kinds of feed to the fineness of flour, or as coarse as may be desired.

Among the special points of superiority claimed for this mill over all others, are: A greater capacity for grinding than any other with the same amount of power; a finer quality of meal with a smaller grinding surface; less surface of stones passing each other, and consequently less power required; a bed-stone which oscillates upon one central point of contact; the spindle or shaft of runner-stone resting upon permanent bearings in an iron frame renders it impossible for the stones to get out of face with each other; simplicity of construction; ready access to and ease of dressing the stones, even by unskillful hands; steady motion and ease with which it may be regulated; and first, last, and most important of all, the grinding stones are of genuine French buhr stock, selected at the quarries in France by experts in the business. In quality they are of a sharp and even texture—some being medium open, and others of a closer texture. They are of the best construction, being strongly encased in iron.

FODDER-MILL.

We advise all interested to address the company as above given for information in regard to prices, terms, and such other details as may be desired.

Anti-Friction Journal Bearings.

John G. Avery, of East Brookfield, Mass., is introing an anti-friction journal bearing, which is attracting a good deal of attention among railroad men and users of machinery. It is being exhibited in Boston on a horse car of the Metropolitan Company's East Boston and Tremont street Line, and the railroad officials state that the car thus equipped runs "twice as easy" as the other cars, the wheels of which are supplied with the ordinary boxes in general use. The car was easily drawn up the hill and around the curve at the head of Hanover street by two horses, while a third horse was needed for all the other cars of the line.

The invention comprises a shell containing hardened steel rolls; a journal of hardened steel, revolving upon these rolls, and the whole working in a box lined with hardened steel. The shell contains 60 rolls, no two of which are in line with each other, and as the journal revolves entirely upon these rolls, friction is decreased to a minimum and no lubricants are required. The box and journal, also, being of hardened steel, are very durable, and will far outlast those equipped in any other way. Rolls are also set in the end of the journal, thus decreasing the friction at that point.

Enormous Crops in 1878.

The December report of the Department of Agriculture shows that the corn crop for 1878 was some 30,000,000 bushels larger than that of 1877. The oat crop was somewhat in excess of that of 1877, making it the largest ever raised in this country. The average yield per acre, however, was less than in 1877, and the quality in most of the States was inferior. There was no material change in the barley crop from 1877, except that California increased her acreage from 450,000 to 650,000 acres, and almost doubled her yield per acre. The total product for the year was, in round numbers, 42,000,000 bushels against 34,500,000 in 1877. The rye crop was about one-sixth larger than in 1877, but the quality of the crop was inferior in the New England (except Connecticut) and the Southern States, while in the States of the West, Northwest, and Pacific slope, it was superior, except in Illinois and Nebraska. The potato crop showed a large decline as compared with 1877, though the acreage was about the same, the difference being less than one per cent. The average yield of the whole country was 96 bushels per acre against 94 in 1877, making a total product, in round numbers, of 124,000,000 bushels for 1878 against 170,000,000 in 1877. The hay crop was 20 per cent greater than last year. Sorghum is receiving increased attention, especially in the trans-Mississippi States and Territories. In Stearns County, Minn., a variety called amber cane is reported as yielding as high as 300 gallons of syrup per acre. Delaware County, Iowa, manufactured 100,000 gallons of syrup during the year, and found a home demand for the whole. The tobacco crop was larger and exceptionally good.

New Gold Discoveries in India.

The production of the metals which are the natural mediums of exchange—gold and silver—has kept tolerably equal, so that the relative value has not greatly changed, except by premature conclusions drawn from some temporarily enlarged production of either in some newly discovered mining district. Thus, some twenty or thirty years ago, gold went down when California and Australia commenced to pour more gold into the trade than for a long time had been previously done. Again, during the last ten years silver has gone down by the large production of silver in some of our Western territories, to which was added the foolish measure adopted in Germany to abolish silver coin.

Now gold again threatens to be lowered in value by largely increased production in India. The new gold discovery there is described as follows: Within an area of twenty-five by thirteen miles, nineteen outcrops were discovered of auriferous quartz from two to four feet thick, yielding from a few pennyweights to 200 ounces per ton. The richer stone, when broken, shows fine and coarse seams and jagged pieces the size of a pea. It is believed that a very large and profitable industry will be insured with the aid of capital and good management.

Correspondence.

ELECTRICITY IN THE WORKSHOP.

To the Editor of the Manufacturer and Builder:

I have rigged up in our shop what may be styled a novel hygrometer. There is a belt 7 inches wide by 4-tenths of an inch thick, running over a pulley in the basement, and another in the second story of the establishment. On the under side of a beam on the second floor, which is in a convenient position, I have fastened a row of sharp points, which project toward the belt, and are as near as possible without danger of catching in the belt. From this I have carried a wire down into the office, and fastened the end to an ordinary electric flyer. On a clear day, especially if it is cold, much electricity comes down the wire and the flyer revolves with considerable rapidity; but as the atmosphere becomes humid, the electricity is dissipated from the belt, either partially or wholly, and the flyer revolves more slowly, or not at all. I find this instrument quite as reliable as the hair hygrometer, or others depending on the same principle.

Townsend Wolcott.

Workshop of the Useful Machinery Co., New York, February 11, 1879.

J. H. C., of Cambridge, Mass., sends us some questions unfit for publication, except in an exclusively medical journal. We will however, for his benefit, mention that open air exercise is the very best thing to strengthen the nervous system and produce sound, undisturbed sleep. The principal thing to avoid is over-fatigue from such exercise. In cold weather and long winter evenings some in-door exercise may be substituted, for instance, a game of billiards or light gymnastics, from 8 to 10 o'clock, and then go to bed. For some constitutions a 6 o'clock supper is insufficient, and the stomach needs something between 9 and 10 P. M. Bread and milk, especially milk, is to be recommended. If this is taken immediately after feeling a little tired from muscular exercise, and then when in bed concentrating the mind on some interesting subject of science, history, literature, or art, to the exclusion of all other existing thoughts, they are the very best remedies to produce quiet sleep—better than any drugs. For our part, we never fail to fall asleep, when we want to, by imagining we hear musical melodies and harmonies. Cold baths are decidedly not good for persons of a delicate or exhausted, nervous system; they produce too much of a shock. Anything that produces on the body a very unpleasant sensation, like a cold bath in winter, is, as a rule, injurious.

Notes and Queries.

This department is intended to furnish, for the benefit of all our readers, information on any subject of scientific or practical knowledge falling within the field of The Manufacturer and Builder. *All persons possessing additional or more correct information than that which we give relating to the questions, are cordially invited to communicate it to us for publication. We also request that all questions or answers be written on separate pieces of paper, and addressed to the Editor.*

QUESTIONS.

(2305) Adulterated Soap.—What is the most common adulteration of soap? How can I detect it?—D. F., Brooklyn, N. Y.

(2306) Shining Writing-Ink.—Please give me a recipe for making shining black writing-ink.—F. W. B., Bloomville, O.

(2307) Improving the Fire Test of Kerosene.—Can the fire test of oils, such as kerosene, be improved by adding or compounding any chemical with it? If so, please furnish me the name of the article and its application.—E. M., San Francisco, Cal.

(2308) Violin and Guitar Wood.—What kind of woods are the best guitars and violins made of ?—A Reader, Easton, Pa.

(2309) Etching Lithographs on Copper Plates.—Can you tell of any way by which I can precipitate metallic platinum upon a copper plate, upon which a lithographic transfer has been placed, without using a warm solution? The trouble with a warm solution would be that it would destroy the drawing in lithographic ink. Would a coating of precipitated platinum be sufficiently strong to resist the action of nitric acid diluted with water in proportion of 1 to 3?—O. R. L., New York City.

(2310) Flow of Water Through Pipes.—What amount of water will flow through a pipe say 2 or 4 inches in diameter, a mile or more long, with a head of 150 feet?—G. M. S., Schroon Lake, N. Y.

(2311) Vanillin.—Can you inform me where Vanillin can be obtained? I saw a notice of it as a substitute for vanilla beans.—S. O. C., Worcester, Mass.

2312) Making Plaster Blocks for Milliners.—Please inform me how to make the plaster blocks used by milliners.—H. V. B., Hillsdale, Mich.

(2313) Furnace for Burning Slabs and Sawdust.—I have a steam-boiler 19 feet long and 3 feet in diameter, furnishing steam for a saw. I wish to burn sawdust and slabs, and therefore would like to know the size of grate to use, the amount of grate area, width of openings between bars, thickness of bars, width of bars, and length of sections; also diameter and hight of smoke-stack. The boiler is rather small for the work required of it.—J. W. G., Canton, Cherokee Co., Ga.

(2314) Proportion of Boiler Tubes.—What do you consider the best length for a 2-inch tube in a vertical boiler working under good natural draft, not to obtain the *utmost* economy, but that will, everything considered, including first cost, give the best practical results?—H., New York City.

(2315) Remedy for Stammering.—Being addicted to that uncontrollable habit called stuttering, and having tried various methods of cure unsuccessfully, I request you for some mode of cure. The habit has prevented me from procuring employment, and I am now working in an establishment as volunteer draughtsman, solely to have something to do and to protect myself from evil habits which may arise from being unemployed. But as I can no longer afford to lose valuable time without remuneration, and being about to enter manhood, I solicit your valuable advice. I must apologize for approaching you on such a subject, but as I know your ready complaisance in answering correspondents, I take the liberty of addressing you.—S. R., New York City.

(2316) Automaton Musicians.—Can you give a short account of the automatons which have been made for the purpose of performing on musical instruments?—S. T., Troy, N. Y.

(2317) Camera Obscura for Drawing.—Will you please inform me how I can make a cheap and convenient camera obscura to draw with.—F. G., Philadelphia, Pa.

(2318) Diphtheria.—Please inform an interested reader how to avoid getting diphtheria, and, when once suffering from it, how it may be cured.—M. G., Camden, N. J.

(2319) Scarlet Fever.—As physicians differ in regard to the treatment of scarlet fever, please give your opinion, and any other information you may possess respecting this much feared disease.—M. G., Camden, N. J.

(2320) Making Brewer's Yeast.—Will you be kind enough to inform me how to make good and cheap brewer's yeast.—E. S., Chicago, Ill.

(2321) Why do Powerful Explosives Act Downward Only?—Please inform your readers why it is that nitro-glycerin, dynamite, giant powder, and other similar modern explosives, always act downward and not upward? For instance, if ignited on top of a rock it will crush it as would the blow of a sledge hammer, while loose powder will simply burn with an upward puff.—S. D., New York City.

(2322) Pitch of Mansard Roof.—What is the regular rule for the pitch of a mansard roof?—C. H., Marmora, Ontario, Canada.

(2323) Pipes for Drinking-Water.—What pipes are the best to use for drinking-water, lead being so objectionable? Is not iron better?—D. W., Poughkeepsie, N. Y.

REPLIES.

(2250) Cast-Iron Electro-Magnets.—We have received two letters on the subject of the use of cast-iron for electro-magnets in induction machines, one from the original questioner, J. H., and the other from C. C., both of this city, in which they affirm that there is no mistake, but that the armature of their magneto-electric machines was found to be cast-iron, and that it operated to their satisfaction. If this is really so, it proves that there are certain kinds of cast-iron which act contrary to the general behavior of that material, and are easily magnetized; and the only advice we can give is to have several made of various kinds of cast-iron and then to try which kind answers the purpose. J. H. states in his original query (page 288 of our last December number) that his castings were a total failure. We are not surprised at this, as undoubtedly there are very few kinds of such iron adapted to his purpose. In the same way we found only one kind which would act similar to steel, and which we could charge with permanent magnetism almost as strong as cast-steel. As such cast magnets were a great deal cheaper we used them for large batteries of permanent magnets for purposes similar to those described on pages 60 and 61 of this number. We found, after many experiments, where the peculiar cast-iron could be found that would serve as a substitute for steel; and our correspondents will have to go through the same experience and try to find a quality of cast-iron that will serve as a cheap substitute for wrought-iron, and possess the properties which J. H. mentions to have been found by Duprez in a certain kind of gray cast-iron, which was magnetized and demagnetized in a somewhat shorter time than forged iron. Such behavior might sooner be expected from gray than from white cast-iron, as in the latter most of the carbon is chemically combined, while in gray cast-iron most of the carbon is only mechanically finely divided, and the iron itself more free of chemically combined carbon, therefore it must act in this respect more similar to wrought-iron.

(2305) Adulterated Soap.—The most common adulteration practiced at present, is to employ a substitute for the expensive fatty acids. They are replaced by silicic acid, which is sand, and of course very cheap. In order to incorporate sand it is changed into soluble or water glass by fusing with soda, and then boiling in water. Soaps thus adulterated are very cheap, but injure the skin, as the silicic acid or sand is a very weak acid and neutralizes the soda very imperfectly. Such soaps are no better than a solution of common washing-soda, and not even as good. To detect it, make a strong solution of the soap, and pour into it some hydrochloric acid; this will take hold of the alkali and separate the acid, which will then show whether it is fat or silica; in the latter case the silica will make the solution thick and gelatinous. Heat will easily show whether the substance separated by the acid is fat or silex.

(2306) Shining Writing-Ink.—You may make any writing fluid shining by adding sugar or gum arabic, or both. Copying inks are always glossy, because they contain much sugar. Glycerin is now used instead of sugar; 1 part of glycerin to 2 parts of ink is the usual proportion, but as such ink does not dry well, (which, by the way is favorable for copying), it is better to use gum arabic alone if you only want the shining quality. A good recipe is to take 1 part of sulphate or iron, 3 of bruised gallnuts, 1 of gum arabic, 1 of white sugar, and 8 of water. If you use gum arabic alone to make shining ink, it becomes too thick and will not flow easily from the pen. If you use sugar alone it will not dry and the ink is liable to turn moldy, or the sugar ferments into acetic acid, which destroys the steel pens. However, molding and souring is easily prevented by the addition of a drop of creosote or carbolic acid, if the odor is not objectionable; if it is, use a drop of oil of cloves or cinnamon, which is just as good, and imparts a more agreeable odor.

(2307) Improving the Fire Test of Kerosene.—There is no chemical that will do this without spoiling the oil for the purpose of illumination. Those who pretend they have something answering this purpose are impostors. The only thing to be done, is not to add, but to take out the volatile and highly combustible vapors, which are the cause of the oil not standing the desired fire test. For this purpose the oil is exposed in an open tank to sunlight, stretching white muslin over it to prevent dust from entering. This will at the same time tend to bleach the oil, and it is one of the methods employed by the best distillers. Of course in warm summer weather it is the most effective; in winter the oil must be warmed by artificial heat—say a steam coil in the tank, which is the best way. It is here supposed that the oil to be treated is really kerosene, and that its defect of too low a fire test is only due to a lighter and more volatile oil—say benzin or gasolin—being mixed with it. If it is all benzin or gasolin, there is no remedy existing that will make it stand any fire test. Evaporation will cause it all to disappear, as these substances are nothing but liquefied vapors, which, by a slight heat, return to the vaporous condition.

(2308) Violin and Guitar Wood.—The sounding-board, that is, the top board on which the strings are stretched, is always made of spruce. Straight grained pieces of uniform density are selected, which are secured by taking care that the grains, which originally are the layers of the year-rings, are at equal distances. The rest of the instrument—the back and sides—is of maple, occasionally of sycamore; in very old instruments sometimes of pear, but this is inferior. For guitars the back and sides are of less consequence, so that in these instruments there is more variety; but the top or sounding-board is always like that of piano-fortes—of spruce. In guitars it is left in its natural color, while in violins the top, back, and sides are stained with a decoction of a mixture of pernambuco, Brazil wood, dragon's blood, etc., according to the fancy of the maker. The varnish is considered of the utmost importance, and made a great secret by some makers. It is carefully made of the purest ingredients, well filtered, made very diluted, and put on as an exceedingly fine coat—just enough to close the pores of the wood and give it a gloss, without however showing any appreciable thickness. You will see from the above that the wood can be found almost anywhere, but you must procure it a long time before using. Cut it to about the shape needed, and then keep for several years in a very dry place, so as to have it thoroughly seasoned, without which all the labor spent on an instrument would be wasted.

(2309) Etching Lithographs on Copper Plates.—The best way to precipitate platinum on copper without the aid of heat, is on the ordinary electro-plating principle, that is, by the use of a galvanic battery. The solution used is that of the double cyanid of platinum and potassium, which must be quite diluted. It will not work well at the common temperature, but better if heated to 90° or 100° Fah. At any rate it is a very difficult operation, the regulation of the strength of the battery being the cause of the difficulty; when a little too weak it will not act, and when too strong the platinum is precipitated as platinum black; often only a mere film of bright metal is obtained, which does not adhere well. Then it is difficult to keep the strength of the solution up to the required standard, as the platinum electrodes conducting the current in the battery are not at all dissolved, as is the case with gold and silver electrodes when gilding and silvering. But we ask, Why platinize when gilding is much easier? Gold will withstand the action of nitric acid as well as platinum, and better, as the always imperfect platinum film will never present so good a protection against the action of the nitric acid on the copper under it as will the more easily obtained gold covering. Therefore our advice is, after transferring the lithograph, to gild the bare parts of the copper plate by the electro-plating process, then to wash away the ink by the proper solvents, and finally to etch with nitric acid.

(2310) Flow of Water Through Pipes.—Water will flow out of an opening with the same velocity that a falling body would attain by freely falling through the hight of the head of water, which, for a 150-foot head, is nearly 300 feet per second. With this velocity it would enter the pipe, if this did not offer resistance; but the velocity in the pipe varies extremely, depending on the nature of its interior, and whether it is straight or has many elbows. A pipe one mile long, would, under the most favorable circumstances—that is, if it were straight and glass lined—lose more than half its velocity; while a rough iron pipe

one mile long would cause a loss which may be roughly estimated at some 90 per cent, so that no more than about 30 feet would flow out per second for a pipe 3¼ inches in diameter, or about 10 square inches section. This would be 30×10 or 300 cubic inches per second, or about one gallon, thus 60 gallons per minute, and 3,600 per hour.

(2311) Vanillin.—Wholesale dealers in chemical preparations keep it, or at least ought to. Address them.

(2312) Making Plaster Blocks for Milliners.—You must first make a model of clay of the shape desired, and then make a mold of plaster over it, divided into several pieces, so as to come apart easily, and so shaped as to stick together when the model is taken out. Into the hollow mold, well greased interiorly with a mixture of tallow and oil, to prevent adhesion, the liquid plaster is poured, and the mold turned around in all directions, so as to make the plaster spread all over interiorly; and it is kept moving until it sets. A second charge is poured in and treated in the same way until the block is heavy enough. When you want it solid and heavy, you may mix sand with the plaster, pouring in last to fill it up. It is difficult to give the practical details in a description, but it would be easy to show you, therefore if you have an opportunity of seeing how plaster casts and molds are made by workmen who are professional makers of ornaments, busts, or statuary, you will learn at once all you want to know.

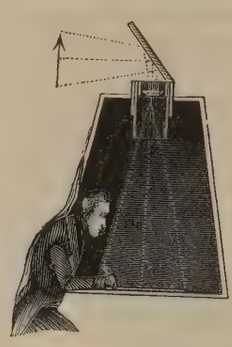
(2313) Furnace for Burning Slabs and Sawdust.—The best way to burn slabs is on a common grate, with a blank plate 12 inches wide at each end, and grates 4 feet long and ½ inch thick. For burning sawdust to the best advantage, a different furnace is required. It should be of fire brick, detached from the boiler, with an opening in the top for feeding. The grates should be arched plates, perforated with holes. A good size for the given boiler would be 3 feet wide by 5 feet long. In mills using such furnaces it is found better economy to give away or destroy the slabs than to attempt to burn them under the boilers, the sawdust being ample and admitting of mechanical feeding.

(2314) Proportion of Boiler Tubes.—The best proportion of length to diameter of fire tubes varies with the conditions of position and draft. For ordinary horizontal tubular boilers, tubes of 40 to 45 diameters in length, for vertical boilers 50 to 60 diameters, and in locomotives 70 to 100 diameters are considered good practice. In all cases the stronger the draft the longer should be the tube.

(2315) Remedy for Stammering.—The cause of stammering usually results from nervousness, which makes you excited in the act of speaking. The best remedy is to try to be quiet without exertion. If a word will not come smoothly, do not persist, but let it slip and use another, even if it does not so correctly express what you want to say. If you persist in trying to pronounce certain sounds, such as those beginning with a *b* or a *p*, (which are the worst for stammerers), the stammering becomes a stronger habit, and at length chronic. All that we can recommend is to take it easy and quietly, and to practice when alone; try and see whether you cannot then pronounce the words with which you have trouble when in company. If so, it certainly arises from nervousness and excitability, and nothing else.

(2316) Automaton Musicians.—There are some wonderful accounts of automatons that performed on various musical instruments, but we will only mention some well authenticated cases. Vaucanson, who lived in Paris the early part of the last century, appears to have possessed great skill in this department. In 1738 he exhibited in Paris a flageolet and tambourine player which was then considered the most perfect androide ever constructed. It played the flageolet with the left hand and beat the tambourine with the right, executing many pieces of music with accuracy. About the same time the Abbé Mical made a number of automaton figures, some in a group, which played different musical instruments. He also exhibited at the Academy of Sciences two heads which articulated syllables. A certain Droz, a skilled French mechanic, had a son, born in 1752, who went to Paris at the age of 22, taking a female figure he had made, which played different tunes on the harpsichord, following with her eyes and head the notes in the music-book, and at the close rising and saluting the company. Maelzel, the inventor of the metronome, still used by musicians, in the early part of the present century exhibited a famous automaton trumpeter at Vienna, which played many of the French and Austrian marches. Still later was the automaton of the ingenious Swiss mechanic, Maillardet, a female figure that performed eighteen tunes on the piano, with the natural movements of the fingers and eyes and heaving of the bosom. It continued in action for an hour, when it had to be wound up again. Among some recent musical automatons, we must mention the automaton clarionet player made by a Hollander named Van Oekelen, which, after having made the tour through various parts of Europe, was exhibited in New York in 1859. It was a life-sized figure, dressed in Spanish costume, and when it was wound up, commenced by bowing before the audience, then, placing the instrument to its mouth, played various operatic and other selections, which could be varied by changing a drum, which was placed in the body at the side of the liver, the rest of the body being filled with wheel-work, springs, key-boards, levers, bellows, etc. The musical sounds were not produced interiorly on a hidden species of organ, as was the case with many other previous automatons, but actually on the clarionet, which was the great merit of this automaton. When the piece was finished, the figure took the instrument from the mouth, and again bowed before the audience. The whole was wonderfully and at the same time comically life-like, the figure rolling its eyes upward when playing sublime passages. The exhibition, however, was not a paying one in this country, as the American people are inclined to practically useful machinery, and do not appreciate such useless things as automaton musical performers. After the inventor and exhibitor died the figure was lost sight of, until some years later we saw it in a neglected and dilapidated condition in a corner of Wood's Museum on Broadway, near 30th street. In regard to automaton singers and speaking machines, their complicated mechanism has been thrown into the shade by Edison's phonograph, which reproduces speaking and singing, and even musical performances, with an accuracy and simplicity of means unapproachable by any mechanism.

(2317) Camera Obscura for Drawing.—For a home-made arrangement, that represented in the adjoined engraving is the



best and cheapest. You only want a lens of some 3 or 4 feet focal length (a good convex spectacle glass of No. 40, or 40 to 45 inches focus will do), and a piece of looking glass (which however must not be common, but good plate glass) of about 5 by 10 inches. They are combined in the way indicated in the engraving, in a conical wooden box, for which however you may substitute a disk on top, with legs, to set on a table, and a curtain of opaque, dark stuff to hang around so as to make it dark inside. If you use a wooden box you must have the hole covered with a small curtain, which hangs over your back when you are at work, so as to exclude the light, which interferes with the distinctness of the image which is thrown by the lens at the top, upon the white paper pinned to the table. The lens must be placed in a sliding tube so that it may be raised or lowered for adjusting the focus. It is evident that the hight of the box must not be less than the focal length of the lens; it is better to have it some inches higher, as when the object is near the lens must be raised. The mirror is hinged in order that its inclination may be changed according to necessity. The engraving itself explains further details.

(2318) Diphtheria.—Cleanliness, not only of the body, clothing, house, furniture, and all that we eat and drink, but especially of the air we breathe. It is strange that the latter kind of cleanliness is so much neglected, and that otherwise clean and particular people, are satisfied to breathe an impure, close atmosphere. It is now well known that living in a house where foul odors can enter, either from sewers, cesspools, sinks, or water-closets, the system is gradually predisposed to diphtheria, which at last breaks out with often fatal violence. The first symptoms are pain in the back, fever, and difficulty in swallowing. If the throat be examined, the mucous membrane will be found to be very red and have the appearance of great fullness; small gray whitish patches may be seen situated on the tonsils, and the glands of the neck will be found to be very much enlarged, this of itself producing another feature, namely, a stiff neck. The fever is not very high, and generally remains about the same as when first noticed, unless some other complication presents itself. The patches in the throat remain, and increase rapidly in size until the whole pharynx is enveloped with the fold of the membrane. In regard to treatment, very little can or should be done toward abating its progress, but much to alleviate the sufferings of the patient and to prevent the further spread of the disease. The patient should be confined to bed, in a room where the temperature can be maintained at 70° Fah. By adopting this precaution the patient is protected from drafts, and the uniformity of the atmosphere guards against undue exposure. As soon as the throat symptoms manifest themselves let the patient use the following gargle, or if a child, give a small teaspoonful of the solution every half hour: Chlorate of potash, 2 drams; chlorid tincture of iron, ½ dram; glycerin, ½ ounce; water, 3 ounces. Mix well and shake before using. If the bowels should be constipated, give an ordinary dose of castor oil or a teaspoonful of syrup of rhubarb. The food should consist principally of liquids, milk, soups, and boiled rice being an excellent regimen to adopt. The best plan is to give nourishment often, and in small quantities, rather than too much at one time. For headache, immerse the feet in hot water for ten minutes, rub them dry, and wrap in warm flannel. Thirst is best relieved by giving the patient small pieces of ice every fifteen or twenty minutes, being governed of course by the chilling effect it may produce. It cools the inflamed surfaces and reduces the sympathetic enlargement of the glands. Disinfectants should be freely used on, about, and around the patient; handkerchiefs, cloths, and towels should either be thoroughly disinfected with a solution of carbolic acid, (forty drops to the pint), or they should be boiled for several hours. It is well to have vessels containing a solution of carbolic acid in different parts of the house, for by these precautions the further spread of the disease may be checked. The burning of sulphur on a small shovel is highly recommended by some authorities, and as it is an article very easily obtained it would be well to give it a fair trial. It is claimed that it is capable of destroying the germs of diphtheria.

(2319) Scarlet Fever.—The treatment of mild cases is similar to that of diphtheria, above described; but there are violent cases, beginning with convulsions, delirium, and fainting fits, which carry the patient off so soon, that the physician has no time to save the patient. It is, in fact, a form of scarlet fever, of which the first symptom is dying. Such cases probably originate in the inability of the system to throw out the poisonous material which cause the eruptions. When these appear soon after the breaking out of the disease, it is, if not a favorable symptom, at least a sign that there is hope of recovery. These eruptions should be promoted, and in no case interfered with, by giving the patient a bath—a mistake which we know several physicians to have prescribed for children, who died soon after. Taking cold is also dangerous, for the same reason, as it may cause the eruptions to disappear prematurely, and the result is most always convulsions and death. Therefore the patient should be kept in a room having a constant temperature, with even more care than is necessary for diphtheria. The first symptoms are a feeling of exhaustion and vomiting, a few chills, and then a high fever, with a small, irregular and intermittent pulse of 120 to 140. When the eruptions appear the fever diminishes. If nausea and vomiting continue give small pieces of ice, the same as in diphtheria. In scarlet fever the vomiting is often very distressing, and there is no better way to control it. Be careful in regard to the diet; begin with rice-water, then beef-tea, and as soon as milk agrees let the patient have it, especially if it be a child.

(2320) Making Brewer's Yeast.—If you want real brewer's yeast, you must start a small brewery and keep it in daily operation, or at least you must do as brewers do, that is, take 72 pounds of unhulled malt and a handful of hops, and stir gradually in a clean tub with 7 gallons of water heated to 170° Fah.; add 5½ gallons of water of 200°; then cover the tub tightly and leave it quiet for 10 hours, or over night. If it is not then cooled down to 70°, this must be done by putting in cans with ice or cold water. When the temperature is 70° it is left for another 10 or 12 hours. At that time 1½ gallons of fresh beer yeast is stirred in. After 12 hours a layer will be formed on top, consisting of the husks of the malt; pierce this and dip out 3½ gallons of the liquor beneath, then stir up and dip out 1¾ gallons of the mixed husks and liquor. This is the mother-barm, from which you can generate yeast the whole year round in the way described, instead of taking beer yeast. To what remains in the tub add 5 gallons of brewer's wort of 90°, and use it within two hours. The mother-yeast must also be used the same day for fermenting another portion.

(2321) Why do Powerful Explosives Act Downward Only?—The statement that they only act downward is utterly erroneous. If you place nitro-glycerin against the side of a perpendicular wall of rock it will act sideways, and if you fix it against the under side of a suspended rock it will act upward with the same amount of energy as it displays in acting downward when exploded on the top of a rock. The fact is, that all violent explosives operate in all directions equally. That they show their effect downward when placed on the top of a rock, is because there is then nothing on top of the explosive to show its upward acting power, as it cannot crush air. But if you lay another large stone on top of dynamite, so as to confine it between two rocks, you will easily verify that it exerts its crushing effects in all directions. That gunpowder, if not confined, burns away with an almost powerless puff, is principally due to its comparatively slow combustion, hence it is so eminently adapted for throwing projectiles, which require time to be put into motion, while a cannon charged with dynamite would burst by the rapid explosion of the same before the ball had time to reach the muzzle, which proves how those explosives exert their power in all directions.

(2322) Pitch of Mansard Roof.—There is no regular rule; but the customary pitch is about 18° or 20° with the vertical, or 1 foot backward for 4 feet rise. The most tasty mansard roof, in our opinion, is a curved incline, beginning on top with a perpendicular descent and bending outward with a hyperbolic curve, until at the base the tangent to the curve has an incline of about 25° with the perpendicular.

(2323) Pipes for Drinking-Water.—Iron pipes are better, but some kinds of water act on them and dissolve so much of the iron that the water will taste after it, while in the course of years it becomes worse and worse, until finally the pipes get so rusty inside that they become perforated. Tin-lined pipes are better, but not fully secure. Wooden pipes are recommended, but they are not clean; they soon rot and cause the formation of material arising from the decay of the wood, and the water will taste after it. The best of all are the glass-lined iron pipes of the Patent Glass-Lined Pipe Company, of this city. They consist of pipes, L's and T's for connections, entirely lined interiorly with glass tubing in the most ingenious manner. To accomplish this was a practical problem which has been overcome effectually.

THE MANUFACTURER AND BUILDER.

Vol. XI.—No. 4. APRIL, 1879. ELEVENTH YEAR.

Improved Automatic Cut-Off Engine.

The steam engine of which we represent a view in our illustration (Fig. 1), is a type second to none in regard to durability and reliable running qualities. This has been attained by: 1st, excellent quality of material; 2d, good workmanship in its manufacture; 3d, capacity of the wearing surfaces; 4th, proper distribution of material, this being accumulated at the points where there is most strain; 5th, correct proportions; and 6th, several valuable improvements applied during the six years that these engines have been doing duty in various establishments.

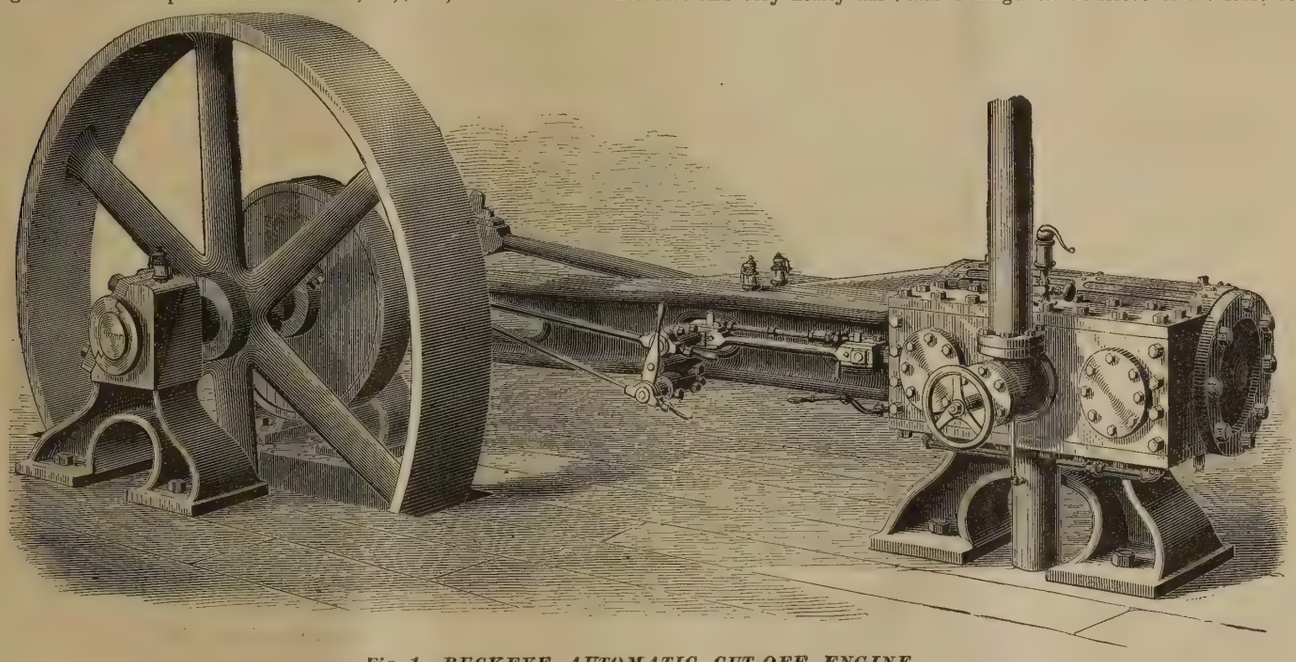


Fig. 1.—BUCKEYE AUTOMATIC CUT-OFF ENGINE

The live steam passes into the interior of the box slide valve, from which it is admitted to the cylinder through ports in its face, as these ports are alternately brought to coincide with the cylinder ports. The cut-off valve, which consists of two light plates connected by rods, works on seats inside of the main valve, and alternately covers the ports leading to the cylinder. The cut-off valve stem works through the hollow stem of the main valve, while the exhaust takes place at the ends of the valve, into the valve chest and into the exhaust pipe below.

Among the features introduced since the first introduction of this engine, are the relief chambers in the valve seat. To understand the use of these, it must be understood that the steam being inside of the slide valve instead of around it, (as with the common slide valve), the tendency of the pressure of the steam in the ports and in the cylinder is to force the valve from its seat, but this tendency is counteracted by the pressure of the entering steam, this pressure being proportioned to the area of pistons or equilibrium rings. These pistons are made large enough to hold the valve to its seat at the moment of admission, when the tendency to leave the seat is greatest. At other times the pressure on the seat would be greater than necessary; but to prevent such undue pressure, live steam is admitted to the relief chambers through small holes in the face of the valve just after it is exhausted from the cylinder, and in turn exhausted from them just before steam is admitted to the cylinder; the result is a moderate and very nearly uniform pressure on the seats at all points of travel, and the arrangement also greatly assists in the proper distribution of lubrication.

Another recent improvement consists in placing the equilibrium rings in the back cover of the valve chest instead of in the cover of the valve, as formerly. The value of this improvement consists mainly in its rendering the equilibrium rings accessible without removing the valve.

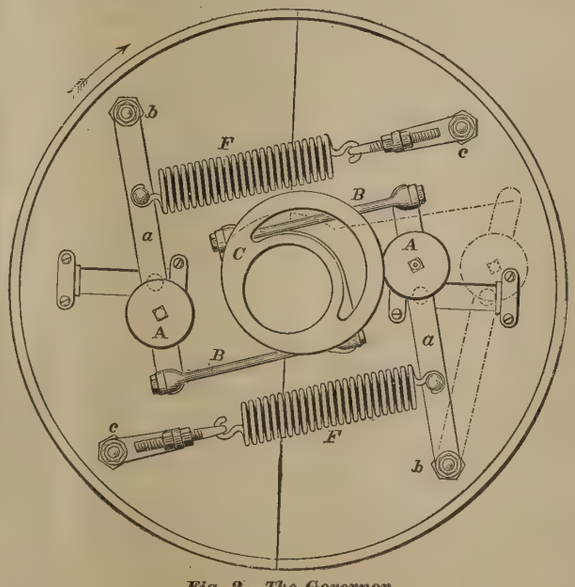


Fig. 2.—The Governor.

The remarkable simplicity of the governor will be clear from Fig. 2. Two levers *a a* are pivoted to the containing case or disk at one of their ends, as at *b*, while the movable ends are connected by links B B to ears or flanges on the sleeve of the loose eccentric C, so that their outward movement, in obedience to centrifugal force (as indicated by dotted lines on the right hand side), advances the eccentric forward in the direction of revolution. Springs F F of tempered steel wire furnish the centripetal force; the tension of the springs is adjustable by screws and nuts, as shown, while the proper amount of tension in any given case is that which will confine the percentage of variation due to changes of load and pressure within as narrow limits as may be desirable—the greater the tension the less the variation—so that if desirable it may be reduced until it is imperceptible. In fact, it is possible to obtain as close regulation with it as the nature of the load and other conditions outside of the construction of the engine would permit with any known method of regulation. The proper speed is obtained by adding more or less weight at A, or, within certain limits, by shifting the weights along the levers. As a rule, the tension is not to be changed to effect changes of speed, though slight changes of speed may properly enough be so effected, provided no objectionable degree of change of sensitiveness results. The parts are shown in their proper position for motion in the direction of the arrow; for motion in the opposite direction the levers are changed to *c c*, and the spring attachments to *b b*. All these governors are so constructed that this change can readily be made at any time.

While the earliest cut-off that the action of the regulator can produce is no earlier than is necessary to re-

strain the engine under its lightest load and greatest steam pressure, the latest will be at ⅛ to ¼ of the stroke, where it meets the fixed cut-off of the main valve, due to its lap and angular advance, and this whole range of adjustment is under complete control of the governor. To appreciate the value of this feature, it should be understood that, with single eccentric releasing gear movements, the governor can only control the time of release during the opening movement of the valve, which necessarily terminates before mid stroke, so that if the release is not effected before mid stroke it will not take place at all during that stroke, thus causing extravagant expenditure of steam and spasmodic irregularities in the motion.

All these conditions are of little value if the expectations they raise are not verified by the great tell-tale—the indicator diagram, and of these we have several before us, which tell a most interesting tale. We will only give a few data of two of them. The first was taken from a Buckeye automatic cut-off, 12 by 20 inch cylinder, running 150 revolutions at an initial pressure of 80 pounds; the cut-off made the terminal pressure 22 pounds, while the card showed the M. E. P. (mean effective pressure) to be, in round numbers, 36 pounds, while that measured to adiabatic curve was 37 pounds, so that 36 : 37, or 97 per cent was realized with a consumption of 19 pounds of steam per hour per horse-power. The other diagram was taken on a similar engine, but with a Korting jet condenser; size of cylinder, 22 by 44 inches, ran 70 revolutions at an initial pressure of 78 pounds, and a terminal pressure of 12 pounds. The M. E. P., according to the card, was, in round numbers, 30 pounds, and measured to adiabatic curve 31 pounds, realizing 30 : 31, or 97 per cent, consuming 13.78 pounds of steam per hour per horse-power. Experts will agree that these results are exceptionally favorable, expecially for the Korting jet condenser.

These engines are manufactured by the Buckeye Engine Co., of 87 Liberty street, New York, who may be addressed for further particulars.

Judicial Mistakes in the Nickel-Plating Lawsuit.

Judge Blatchford has repeated his first erroneous decision in the case of the owners of the Adams patent against various nickel-platers in the United States, who had appealed from his first decision against them. He again bases it upon the argument that "the process employed by the defendants gives a coherent, consistent and tenacious coating of nickel; that the means by which this coating is secured are described in Adams' patent of 1869, and that no practical plating can be done unless that process is used."

This is a wholesale assertion, of which there is no proof. The most experienced chemical expert in this line of business will not pretend to assert how many new kinds of solutions may yet be discovered, all of which may give "a coherent, consistent and tenacious coating of nickel." We personally know of more than two solutions that will do it with the proper battery current, which is a most important agency in this respect, and these solutions are not only unclaimed by the Adams patent, but even made contrary to his prescriptions, in such a way as to contain the very substances which Adams claims will prevent the formation of "a coherent, consistent and tenacious coating."

On page 90 of this issue we give a solution which is now offered for sale in England, guaranteed to give "a coherent, consistent and tenacious coating," and not prepared according to the Adams process, as it is a double salt of the cyanid of nickel and potassium, containing therefore the very substance condemned by the Adams patent. The solution is superior to any other thus far made, and much superior to any of Mr. Adams' attempts at nickel-plating. We would like to know what Judge Blatchford, and the experts who advised the wrong decision, have to say about this. Probably they do not know that solutions have been found that will even nickel-plate without any battery at all; one we have already described on page 83 of our April number for 1877.

The essence of this whole matter is that Mr. Adams has proved that he does not understand everything about nickel-plating, that the judge knows less about it, and that the experts engaged by the owners of the Adams patent, and upon whose expressed opinion the judge's decision appears to have been based, acted against their scientific convictions. We are sorry to be obliged to use such severe expressions, but as we cannot suspect these experts of being ignorant, or at least illy informed upon so important a subject, there is no other conclusion left than the one expressed.

A few $500 checks may cover a multitude of sins.

The Manufacturer and Builder.

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This journal has the largest circulation of any mechanical monthly published in the United States. Its value as an advertising medium is therefore apparent.

Vol. XI. No. 4. ELEVENTH YEAR.

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Perpetual Motion Again.

We trusted that the idea of the utter impossibility of perpetual motion had at length penetrated the skulls of that class of editors of magazines, who have a department devoted to science, under the title of "Editor's Scientific Record." It appears however that this is not the case; *Harper's Monthly* for March contains a description of a perpetual motion machine, said to have been invented by a certain Mr. Gary, who uses the attraction of permanent magnets to produce a motion which generates its own power, and it is seriously stated that he has made one exhibiting a continuous oscillatory movement, and another exhibiting a perpetual rotary motion. The details of the machines are actually described and illustrated with wood-cuts, and it is added that professors from Harvard and from the Massachusetts Institute of Technology have called, examined, and *were impressed*, and that capitalists moved more promptly than scientists. We believe all this; it is the story of the Keely motor over again. Capitalists, in their unreasonable zeal for great profits, and their equally unreasonable ignorance of nature's fundamental laws, think that they know more than scientists, in case there is a question of investing money, even when the success of the enterprise depends entirely upon correct scientific principles, of which they actually know nothing, but should conform their judgment to those whose business it is to know them.

This is one of the several humbugs in regard to which, during the last few years, we have been consulted for an opinion. In every one of them there were small capitalists (and, by the way, they are those who generally take the largest risks), who invested contrary to our advice. One case was the Kraffert ice machine; another was blue glass; another the Keely motor; another a similar invention in Brooklyn, etc. After having lost their investments, either in buying stock or giving direct financial help to the inventor, and expressing to us their regret, we perhaps cruelly retorted: "It served you right, and is your own fault, because you had more faith in embellished, ignorant boasts than in plain scientific statements." We believe also that it is true that the professors in Boston were impressed, but only with the barefaced impudence of those interested, who do know better, and the deplorable ignorance of the others.

The principle on which this pretended perpetual motion is founded, is the assumption that the attraction of a permanent magnet can be intercepted by a screen of iron when placed at a certain distance, which is that called by Mr. Gary the neutral line. It is evident that if this were true, we could cause alternate attractions of masses of iron by moving the screen alternately in front of a magnet, and in this way we would have motion of these masses of iron, which could then be made to move the screen, in the same manner as a moving steam engine opens and shuts its own slide valves. The same would be true of gravitation if we had a substance by which the action of gravitation could be interrupted. Spiritualists pretend that they possess it, but we have never seen the proof of it, notwithstanding a search of twenty-five years and an offer of $1,000 to any spiritualist, who could cause the scale of our chemical balance to move upward, when charged with so small a weight as only the ten-thousandth part of a gramme.

Now, the fact is that there is as little hope of interrupting magnetic attraction in such a way, to obtain motion, as there is of interrupting gravitation. If in the case of magnetism this is attempted to be done with a piece of sheet-iron, the phenomena become somewhat complicated, as the sheet-iron itself becomes magnetized by induction; and it is this which misled Mr. Gary, who evidently is entirely ignorant of the extensive series of investigations which permanent magnetism has undergone for more than a century, and has misinterpreted the little details which he observed in the attractions. He saw that when a piece of soft iron is held at a certain distance—say two inches—from the poles of a steel magnet it also becomes magnetic, and will support a small nail; when the iron is brought nearer, the nail will drop off; as soon as a certain distance is reached, closer to it, it will hold the nail again. He calls this distance the neutral field, and pretends that when the iron screen is placed at this point it will intercept magnetic attraction. He also claims that a change of the induced polarity of the iron takes place at this point, and the poles become reversed, and, reasoning from these premises, he makes the theory of his motor plausible to those not well informed on the fundamental principles of mechanics.

We have not the space to go into the details of his experiments, but any one who has a strongly magnetized steel horseshoe, an iron bar, a few nails, and a piece of sheet-iron, can easily verify the experiments stated, and if he consults a text-book on the subject will have no trouble to interpret in a rational way what he sees. This is what Mr. Gary lacks; he labors under the disadvantage of many other men, who have educated themselves in a certain branch of science,

have framed a false theory of their own, and cannot see anything outside of their theory, by which they finally come to absurd conclusions, and this is the case with the party under discussion.

We have witnessed similar cases among uneducated persons who made a special study of optics, astronomy, acoustics, electricity, galvanism, etc.; now we have such a case in mineral magnetism.

We wonder how many capitalists have been induced to invest in consequence of this advertising puff in *Harper's Monthly*. As the magazine has thus far enjoyed a fair reputation, it is likely that several parties with more money than brains have gone into the thing, because we consider the whole aim of the article to be "to raise the wind," to use a slang phrase, and to transfer money from the pockets of one class to the pockets of another, without final benefit to science or industry.

We also wonder how much was paid for the insertion of the puff, not as an advertisement, but as a scientific article, and endorsing it by withholding any critical comment. This must be worth a good round sum to Mr. Gary as well as for the money consequently flowing into the treasury of his associates, as compensation to the Harpers' for the damage done their magazine, which thus far has maintained a fair standing, but has now fallen to the indiscriminate endorsement of an ingenious fraud.

Our Foreign Immigration.

The greatest blessing for a country with an abundance of national resources and a sparse population, like the United States, is the immigration of an industrious, quiet, and sober race. If they intend to become American citizens, it is much better for the material progress of the nation; but even if they come only to make money, save it, and intend to return with it to their native country, it is a blessing, as the products or the results of the labor performed by them, and which they cannot carry off, but must leave behind, are necessarily of much more value than the money they have earned, as no employer ever pays wages if the value of the products obtained by that labor do not exceed the amount of the wages to such an extent as to make it an object to employ the men.

We have a striking illustration of this fact in the result of Chinese labor in California, lately brought forward by the Rev. Joseph Cook in a lecture delivered by him in New York city. He said:

"The Surveyor-General of California says the Chinese have increased the value of the property in that State $290,000,000, and this property to-day is held by white men. Have any 200,000 other nationalities done as much as that for California? Where is the Sand-Lot orator that dare say that his race on the Pacific coast has added $290,000,000 in value within ten years to the property in California held by white men? These Chinamen have, according to official statements, reclaimed a million acres of marsh lands, for which white labor could not be obtained; even if the men could have been found at that time, they would have refused to do that kind of work which the Chinamen did at the risk of health and life. The land redeemed was worth $3 an acre, and is now worth $100 an acre, and each one producing 75 bushels of wheat. These enterprises have given employment to 500,000 white men, and these men now turn on their benefactors. I undertake to say that there has not been on the face of the globe, since the first immigration of the English to this country, as profitable an immigration as these official figures show."

Among the various races which exist in this country, and are despised by the European races, either native or foreign, are the Indians, the negroes, and the Chinese. The first are indigenous and the original owners of the soil; but the race is lazy, and disinclined to regular, well-organized labor. It is the same with the negro; but the latter has the advantage in being docile and submitting to the dictation of those whom he feels to be superior to him. In this way the negro race can be, and has been, made highly useful, as has been proved in the Southern States, which, without negro labor, could never have produced that great staple of American commerce—cotton; nor sugar or rice, or other fruits of the rich sub-tropical soil. The difference between the Indian and the negro character is patent from the fact that nobody ever thought of making an Indian a slave, or of using him as a house-servant, for which latter occupation the negro is especially adapted. By the abolition of slavery we have done justice to the negro as a member of the human family; but are we doing justice now to the Indian, who is a man and a brother as well as the negro?

We wish the abolitionists, whose occupation is gone, would now turn their attention to the Indian question, and prosecute that with the same vigor they did the negro question. This, however, is scarcely to be hoped for, as no English influence will be brought to bear upon this subject as it was so largely brought upon the negro question, and this for the reason that Great Britain was most intensely interested in cotton, the product of negro labor, and besides expected that the slave question would break up the government of a country which threatened to become a powerful rival, (as it already is at this moment). England is not in the least interested in the Indian, neither is there any hope that the agitation of this question will foment a civil war here; if it were otherwise she would long have sent her agents among us, as she did for several years before our civil war, the results of which have certainly caused her great disappointment.

As the average Indian, from the nature of his character, appears unfit for civilization, the extermination of this race appears to be unavoidable, with the exception of a few small tribes who have been induced to abandon the roving style of life, settle down, and cultivate the soil.

Of the other despised race, the Chinese, whose usefulness in California we have mentioned, we are in justice obliged to add that the accusation in regard to their vices is unjust. The lecturer referred to above also said:

"Talk about the contamination of Chinese vices! There is more money lost in a single year in the white gambling saloons of San Francisco than ever was lost in similar places kept by Chinese. And no Chinaman ever opened a whiskey mill. When I hear men who are rolling in iniquity, crying out against Chinese vice, and when I see a crowd of adult hoodlums applauding younger ones who beat out the brains of a child of yellow skin with brickbats; when I see settlements burned down, with no policeman to shield or avenge the unfortunate; when I see even murder condoned, I feel almost like calling upon God to give us somewhere on the Pacific coast—I had almost said—a riot large enough to bring out the entire military power, so as to impress upon San Francisco the dignity of her days of the Vigilance Committee. If the Mayor of San Francisco, if the Governor of California, wishes to represent the sentiment that will carry the votes of the serious parts of this land; if there is to be union between the best politicians of California and the rest of the country in the next Presidential election, the thing for San Francisco to do is to keep order, not only in Chinatown, but on the sand lots; to seize by the nape of the neck the mobocracy and the hoodlum quarter of San Francisco, and, if necessary, by the nape of the neck the Chinese quarter also, but at any hazard to keep both in order, to preserve the fundamental principles of our national policy, and to make first pure and then peaceable the Pacific coast, so far as it is trod by cheap labor."

The speaker added that Chinese immigration has thus far done more to benefit this country than any equal number of recent European immigrants ever did.

Without disparaging any nationality, we may be allowed to classify this European immigration, in that of the Northern and Southern, of which the Northern or light-haired, or Teutonic races, are the most valuable. They are the German, English of Anglo-saxon descent, Northern French of Gallic descent, Scotch, Dutch, Belgian, Danish, and Swedish. The Southern, dark-haird or Latin races, are the Southern French of Frank descent, Italians, Spaniard, and the Irish of Celtic descent.

The prevailing difference between them is that the first-named are the most quiet and law-abiding, while the last-named are the most turbulent. In regard to their industrial tendency, it is also in favor of the first, among whom the Germans and French stand foremost, while the Spaniards are low down on the list, as proved by Spain itself and the Spanish-American republics, where, instead of ardent devotion to industrial pursuits, political intrigues and revolutions are the order of the day.

If we compare the quiet industry of the Chinaman, who does not pretend to meddle with polities, but is satisfied with his daily bread, giving full value for the wages he receives, with the noisy arrogance of many European races who immigrate to these shores, and their vices of drinking, gambling, etc., we almost feel ashamed of our own race.

The expression of the above truths may not be liked by many, but justice requires that from time to time the truth should be stated, whether it be palatable to all or not.

New Motive Power!

Quite recently we were interviewed, professionally, by a stranger, who came to obtain our opinion in regard to a great invention or discovery he claimed to have made, and, after some hesitation, confidentially communicated to us. It was that water pressure could be used to drive machinery, and even an engine originally made for steam pressure. This discovery he said would do away with the dangers connected with steam-boilers, making them useless.

Our answer was, that in the first place the idea was not only not new, but that such machines were in use; for instance, for blowing church organs, and that he could see them in operation in Mr. Beecher's church in Brooklyn, and other places.

But our visitor doubted whether water had been applied as power for driving machinery just as steam-power was now used, for instance, to drive printing-presses. We mentioned that we knew of several such applications, one in Hartford, Conn., where one of the newspapers was printed by water acting on a piston-engine, and that such machines were even manufactured there by the Pratt & Whitney Company, and we laid before him the description and illustration of these machines given in our June number for 1875.

Our visitor, after looking at the illustration, said he had been informed that it was a similar device that Mr. Keely with his motor was after, and he expressed his surprise that it had not long ago been applied to steamships. We modestly suggested that they could not obtain the power.

"Well," said he, "have they not got plenty of water?"

We gave it up.

Enormous Profits Made on Gas Stocks.

In an item entitled "Electric Light vs. Gas," on page 50 of our March number, it was erroneously said that a cubic meter is nearly 10 cubic feet. This is the ratio for the square meter compared with the square foot, which number unfortunately was substituted for the ration of the cubic meter to the cubic foot; the latter ration is 35, so that the passage referred to should read thus: "The cubic meter is nearly 35 cubic feet, which makes the price in Paris 1 cent per cubic meter, equivalent to a little less than 30 cents per 1,000 cubic feet." It will be seen that this correction of the figures shows that in Paris gas can be furnished at one-tenth the price it is sold at here; a most surprising fact, which demonstrates still more forcibly the enormous profits realized by our gas companies, as the materials used—coal and petroleum—are certainly cheaper here than over there, coal being comparatively scarce in France, while petroleum, so far as we know, does not exist there

Latest Improvements in Brick Making Machinery.

Considering the hard and disagreeable labor required to make bricks by hand, and the monotonous motions the brick-maker has continually to go through, it is not surprising that for some years past the minds of inventors have been exerted to contrive machinery by which this could be accomplished by steam-power. The efforts of various inventors have been crowned with more or less success, and several brick machines are now in the market. They, however, labor under the defect that the bricks made by them, after being burned, are not of equal dimensions. The cause of this is to be found in their different densities when the clay leaves the mold, a result of the fact that it was found practically impossible to furnish an equal amount of clay to each of the mold boxes, hence a different amount of compression, of density, and of shrinkage during the baking process. Another defect is coincident, namely, the bricks which have undergone less pressure, and are less dense, are weaker and fragile, lose their edges and corners, become unsuitable for face or front bricks, and therefore greatly reduced in value.

It was the purpose of Mr. Gregg to overcome these difficulties, and the result was the machine which we represent on this page; it molds bricks of uniform size, density, and strength. In order to understand its nature we will speak first of brick machines in general; they may be divided into three classes—dry clay machines, slush machines, and crude or moist clay machines. From the peculiar construction of dry clay machines where "filler boxes" or graduating measures are used to fill the mold boxes, the clay must be dried and granulated to be capable of being filled with any degree of regularity into the "filler boxes," and thence into the molds; and when molds are grouped together it becomes a physical impossibility by the dry clay system to fill them alike, hence those deficient in clay will but partially develop the bricks; this, added to the fact of the cohesive quality of the clay being destroyed by extracting the moisture before molding, complete vitrification cannot take place in the burning, and the result is that bricks made from dry clay, disintegrate with the action of the elements.

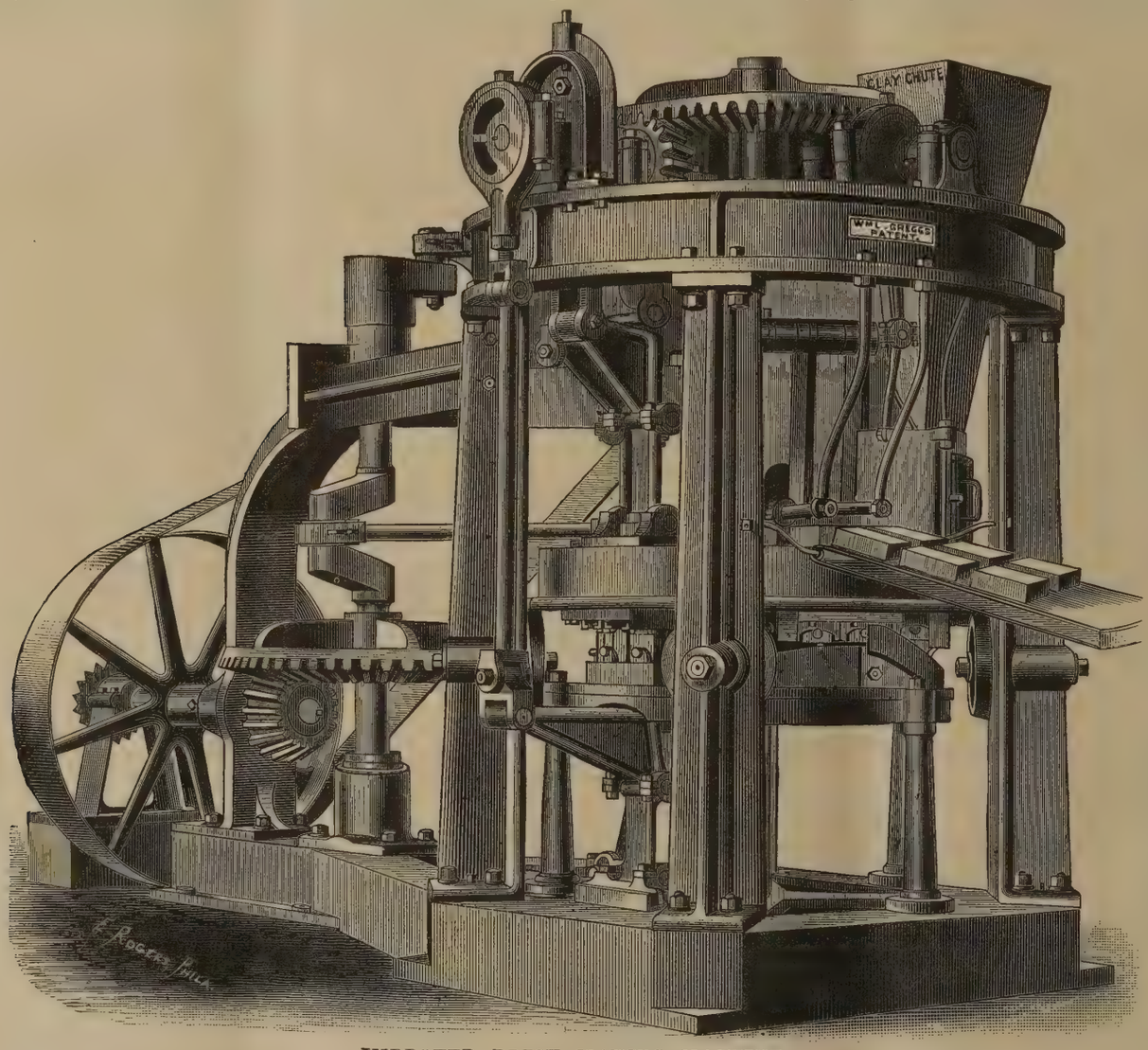
In the manufacture of slush brick the other extreme is met. To facilitate molding in the "hand way" a large proportion of water is added, and the bricks being so soft must be spread upon floors to dry. The slow out-door process of drying, or evaporation, is one of the most favorable processes for the hand brick maker, but it requires the continuous insurance of favorable atmospheric influences and a continuity of fair weather, which practically can never be relied upon. Clay, to be made into bricks by hand molding, must of necessity be so wet that at least 25 per cent of water has to be evaporated before it is safe to turn, so that in fact in works producing 30,000 bricks per day, upwards of 23 tons of water have to be evaporated therefrom every 24 hours. The labor attending this is an expensive item, and the bricks are rendered porous by the operation.

Gregg's triple pressure and combination machines occupy a medium position between dry clay and slush machines, and a first great saving is effected, as the machines accept the crude clay and manufacture it to advantage in so stiff a state as not to contain more than one-eighth of the above amount of water to be evaporated, and yet all of its cohesive qualities are retained.

In regard to the mechanical construction of these machines for moist clay, we must state that the heavy developing pressures take place while the mold table is at rest, thus requiring but a nominal amount of power to operate them, and avoiding strain, wear and tear, and breakage, as well as the great propelling power which is the general concomitant of other machines. When the bricks made of such clay and molded to a great and equal density, are baked, the fusion is more complete, the bond between the clay particles more perfect, the bricks less porous, therefore they absorb less moisture, and are much stronger.

Comparative hydraulic pressure tests have been made between the bricks made by the Gregg machine and hand-made bricks; the result was that while hand-made front bricks were crushed at a pressure of 42,000 pounds, the machine-made front bricks stood 60,000 pounds; when burned hard, the hand-made bricks were crushed at 49,000 pounds, while the machine-made bricks stood 55,000 pounds. When half and quarter bricks were tested the difference was still larger, as the hand-made bricks showed a falling off in strength nearly proportional to their size. This was by no means the case with the machine-made bricks, of which half and even a fourth part were almost as strong as the whole brick. These experiments were verified by direction of the supervising architect of the United States at the Treasury Department, and the result was an order that the Gregg bricks should be used for government work.

This fact, in connection with the highest premiums at all the exhibitions in Europe and in the United States, makes it needless to give here any of the testimonials which are published in the catalogue of the manufacturers, from which we will only extract the result of a tabular calculation of the comparative ex-



IMPROVED BRICK MAKING MACHINE.

pense of hand-made brick and that of bricks made by the No. 1 Gregg triple pressure brick machine here represented; it is that the wages of ten molders, ten bearers, ten wheelers, one temperer, and one pitman amount to $252 per week, producing 150,000 bricks; while the expense of one engineer and machine man, one feeder of machine, two off-bearers, one wheeler, expense of coal, oil, and waste amounts at most to $52, also producing 150,000 bricks. Thus we have here a saving of $200 per week, which soon pays for the cost of the machine, while the profit on the bricks is largely increased, the hand-made bricks costing $1.68 per thousand, made ready for burning, and the machine-made bricks 30 cents.

We recommend all interested to address the Gregg Brick Co., 402 Walnut street, Philadelphia, Pa.

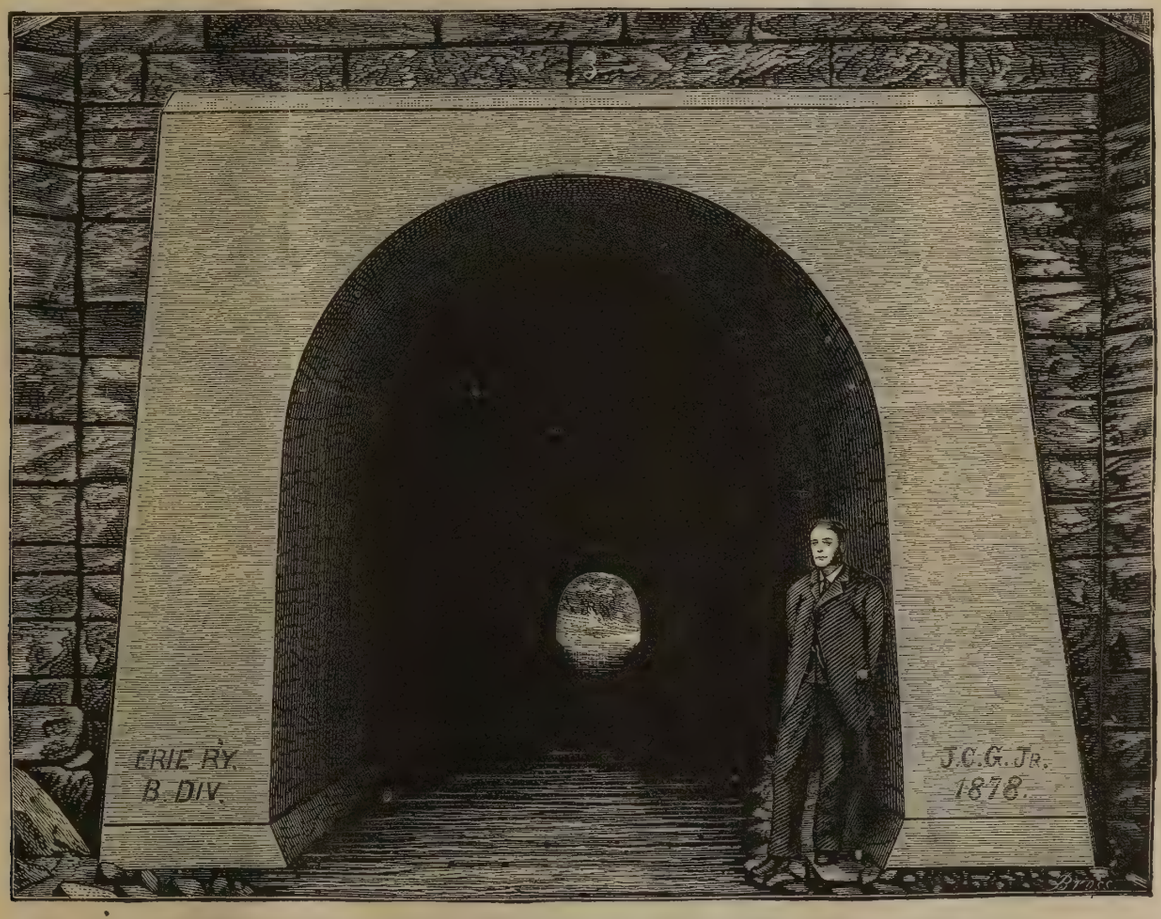
Culverts vs. Bridges.

Since the introduction of iron, and of wood-work braced with iron, it has become quite customary among our railroad engineers to bridge cuts and valleys, even when they are several hundred feet in length and as much as 50 feet deep over water-ways, while the latter may be only 20 feet wide, and their rise during seasons of flood do not require extra water passages on the banks of the stream. In such cases it is much cheaper, stronger, and more durable to construct an arch of masonry over the stream, and fill in with an embankment over it. Experience has shown that up to a width of 50 feet an arch is cheaper than a bridge of iron, and even for greater widths it may be cheaper in the end, as it is certainly more durable, provided the masonry is of good quality and the arch constructed on sound principles, so as not to be such miserable failures as some of the arches lately built by contract in the streets of New York city, and which came down by their own weight, or that of the earth over them.

The advisability of stone arches was already acknowledged by early railroad builders in this country, as witness the large number of such arches and culverts along the earliest constructed railroads. Unfortunately, however, the builders have not always been careful in the selection of their building material, and have often, for the sake of economy, been compelled to use what they found at hand, from want of experience in this line, not knowing the worthlessness of the argillaceous shale abundant in some parts, which possesses the serious defect of slacking by age and crumbling to dust. Many arches and culverts of this kind are disintegrating very fast, and are evidently destined to go to utter ruin; and it has thus far been a problem as to the best thing to do in such cases.

In some instances it was concluded to build a bridge next to the old embankment, but this was expensive. In other cases it was concluded to build a new arch, but this necessitated: 1st, the removal of the embankment over it; 2d, the construction of a temporary tressel-work, with railroad on top, to pass the trains during the labor of rebuilding; 3d, the construction of the new arch of better stone-work, and after the re-building of this; 4th, to fill in the embankment again; 5th, rearrange the track, and, 6th, remove the temporary tressel-work; while, 7th, a continual extra car was required to fill in the newly dumped earth for several months after the trains commenced running again, so as to sustain the grade of the road.

It is evident that this required time and money, and involved danger and loss in regard to the running of trains. Fortunately, the method invented by Mr. John C. Goodridge, Jr., and practiced by the N. Y. Stone Contracting Co., office 3d avenue, corner 6th street, Brooklyn, N. Y., of which he is President, obviates all this expense and trouble, with a more satisfactory result. The method is this: A new arch of beton is placed inside of the old arch of masonry; the beton fills all the holes in the masonry, and therefore is the strongest where the old arch is the thinnest. The old stone is prevented from further disintegration, and held in position by the new, strong cement. The embankment and track are kept entirely in place on top, while a smooth passage is made for the water below, and at the same time the culvert is made better than new, for it has all the advantages of both. The cost is not one-fifth the expense of a new one. Our illustration represents an arch of this description, as constructed on the Erie railroad, about four miles east of Warsaw, N. Y. Specimens of this work can be seen that have stood perfectly for nine years. Fifteen such culverts were lined and repaired by this company during the summer of 1878.



CULVERT ON THE ERIE RAILROAD.

Another Nickle-Plating Solution not Patented by Adams.

To a dilute solution of chlorid of zinc, 5 to 10 per cent., nickel sulphate is to be added to impart a decidedly green color to it, and the solution is then heated to boiling in a porcelain vessel. The clouding of the liquid from a separation of a basic zinc salt need not be heeded, as it will not interfere with the effectiveness of the bath.

The articles to be nickel-coated—first carefully cleaned of oxid or grease—are only suspended in the solution from thirty to sixty minutes, while no battery at all is required, only the bath must be kept at a boiling temperature. When the articles are uniformly coated, they are removed, washed in water in which a little chalk is suspended, dried and polished with chalk or other suitable material.

Making Mills Fire-Proof.—European periodicals have been discussing the best methods of making flour mills fire-proof, especially so far as mill explosions are concerned. One point insisted on is that the apartments, especially the separator room, should be separated by fire-proof doors and shutters. Iron was objected to because this bent in the heat, and thus allowed the flames to pass through. It was then suggested that wooden doors covered with zinc would be better, but the Magdeburg Fire Insurance Company, a millers' association, say that the experiments with zinc doors have been unsatisfactory. The company is now making experiments with fluted iron.

How to Raise Steam Economically.

One of the greatest problems of modern times, and which has a direct bearing on the prosperity of industrial nations, is to produce steam at the greatest possible minimum of expense. If we consider that the consumption of fuel is a continually recurring expense, that in many establishments it constitutes the greatest outlay, and that by the active competition in all branches of trade, expenses have to be reduced to the lowest possible figure so as to work with profit; when we consider that in many instances manufactories have even become ruined by the neglect of owners to apply economical improvements, while their competitors who took advantage of newly improved inventions tending to economize, succeeded; when we look at all this, we say that it is no exaggeration to claim that economy in generating steam is one of the most important problems of modern times.

For a long time those engineers who make deductions from close observations, agree that the water tube boiler is thus far the most economical, especially by reason of its large heating surface and free circulation, when properly constructed, and that therefore from improvements in its construction, the greatest economy was to be expected. This conviction has even dawned upon the steam engineers of Great Britain, who for many years were so ultra-conservative as to stick to the notion that the old fashioned Cornish boiler was the most economical of all.

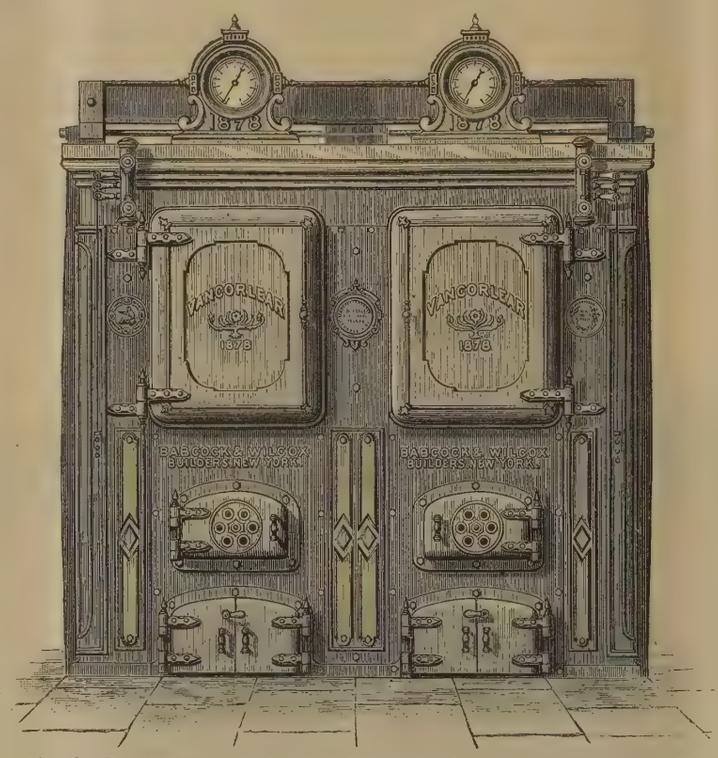


Fig. 1.—Front View of Babcock & Wilcox Boiler, as Erected in the "Van Corlear" Apartment House, Seventh Avenue, New York.

Fortunately, this illusion has at last been exploded by comparative and honestly conducted experiments, and since that time the principal mechanical journals published in London, such as the *Engineer* and *Engineering*, have been discussing the necessary elements of success and the reasons why some of these water tube boilers did not come up to just expectations.

It is a very creditable proof of the practical tendency of the American people, that while in England such discussions were going on, and nothing practically valuable was accomplished in this direction, one of our American firms was quietly experimenting and practically working out the grand problem, and has succeeding in bringing into extensive use a plan for a water tube boiler, which contains all the elements that the most exacting steam engineer could ask for in a perfect steam generator. In our illustrations, Fig. 1 represents a front view, and Fig. 2 an interior view of such a steam generator. Fig. 3, on the opposite page, is a side view of up-take, and represents the way the tubes are connected by the up-take, of which Fig. 4 shows a front view, and plainly exhibits how the tubes are staggered, so that one row comes over the spaces of the preceding rows, by which they receive greater benefit from the heated gases than if they glide along through straight channels, as is the case in most other steam boilers.

As we have on a former occasion given a detailed description of this system of boilers, we need not add anything more, except to call attention to the absence of joints exposed to the direct fire, the economy of circulating the fire and heated gases up, down and around the tubes, and to the infallibility of the circulation of the water, which continually brings it from the lower and cooler to the higher and hotter parts of the tubes. The result is that these boilers are eminently adapted to fulfill sudden and enormous demands for steam, such as are often made upon boilers in large manufactories, hence they have been found superior to any others in such establishments, and are every year displacing existing boilers.

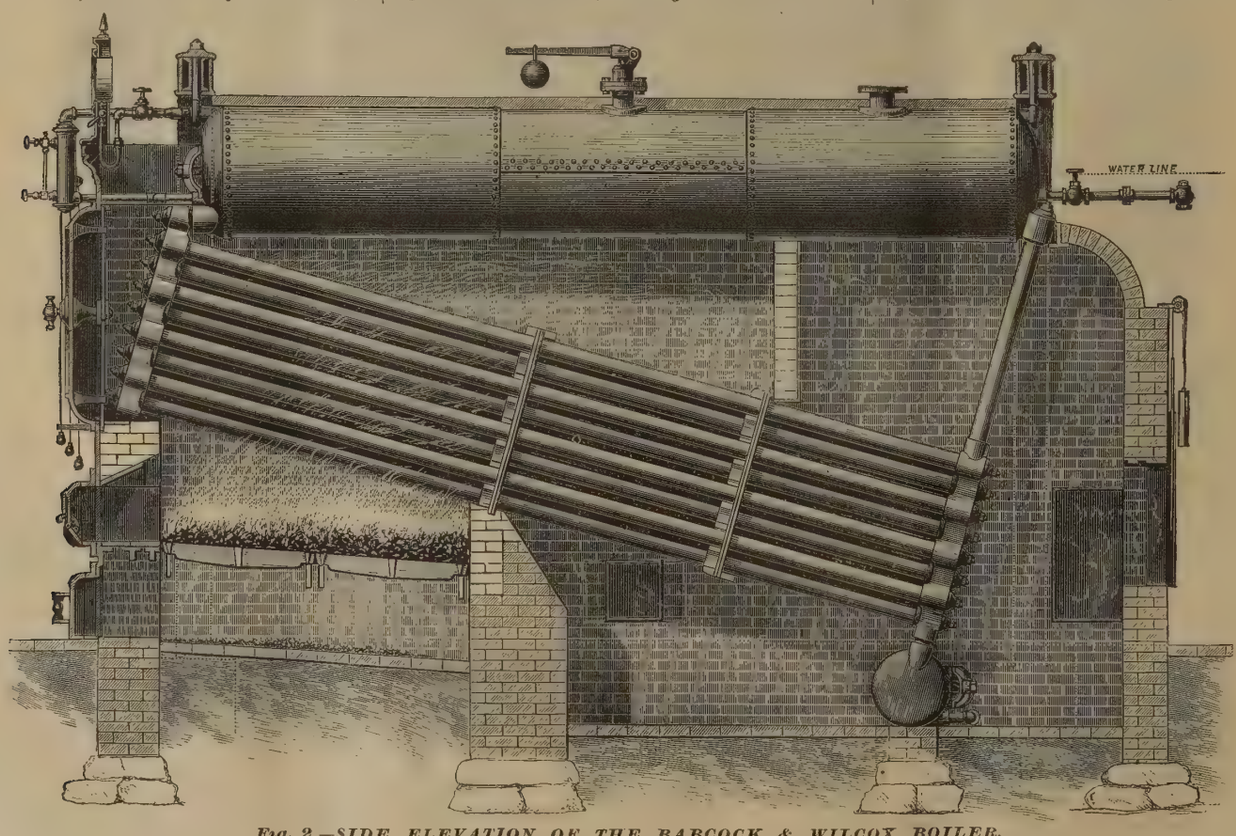


Fig. 2.—SIDE ELEVATION OF THE BABCOCK & WILCOX BOILER.

Tests of Boilers and Engines.

Engineering Office of Chas. E. Emery,
No. 7 Warren Street, New York,
March 21, 1879.

Messrs. Babcock & Wilcox:
No. 30 Cortlandt Street, New York.

Gentlemen: As requested by you, I, on the 4th and 5th of February, 1879, made a trial of the Babcock & Wilcox boilers and Corliss engines in the Raritan woolen mills, Raritan, N. J., the results of which are shown in the following report:

There were two boilers tested of the water tube type, manufactured by you and known by your name, rated jointly at 360 horse-power, and reported to contain 4,080 square feet of heating surface, and 108 square feet of grate surface. These boilers were erected side by side and connected so that they could be used separately or conjointly in connection with or independent of a number of Lancashire drop flue boilers, three boilers of the latter kind having been removed to make room for yours. All the boilers were connected to a single chimney through a Green's economizer in the

flue. A large portion of the steam generated appeared to be used in the dye house and for heating purposes. A portion of the boilers were employed, however, to supply steam to two pairs of engines, of equal size, operating the mill, one pair being of the Wright patent, put in many years since, and the other of Corliss make, erected within a year. Each steam cylinder was 20 inches in diameter, with 48 inches stroke of piston. The engines are provided with Bulkley condensers. In the ordinary working of the mill your boilers were used to supply steam to both pair of engines.

Your contract contained a guarantee that the boilers should furnish sufficient steam to develop the rated power (360 H. P.) in a Corliss engine, and that the evaporation should equal at least 9 pounds of water from a temperature of 180° per pound of coal containing not more than 12 per cent of refuse. In a preliminary trial, part of the load on the Wright engines was transferred to the Corliss engines; but it was soon found that the latter did not require all the steam your boilers would generate economically; so two trials were made, one of $4^1/_6$ hours duration, using your boilers with reduced draft to supply steam to the Corliss engines only, and taking data to ascertain the economy of the engines; the other of fully 12 hours duration, using the boiler at *maximum power* on a dull day without forcing the fires, part of the steam being used to operate the Corliss engines, the remainder blown into the pipe system of the other boilers, which were working at a much less pressure.

TRIAL OF THE BOILERS.

The experiment commenced at 6.01 A. M., and closed at 6.38 P.M. In starting, steam was raised by spreading the banked fires left from the previous day. When the pressure reached 80 pounds the fires were hauled, all refuse removed, and fires started anew with wood, which in calculation has been considered equal in calorific value to $^4/_{10}$ its weight of coal. The fires were maintained with coal during the day, finally hauled, allowed to cool, the combustible portion deducted from the coal charged, and the refuse weighed separately. The experiment was closed when the boilers stopped making steam at 80 pounds pressure, with water in the glass gauges at the same hight as at starting.

During the trial, all the coal consumed was weighed in an iron wheelbarrow, balanced when empty by a fixed weight, and each barrow load was adjusted at the scale to weigh 200 pounds net. All the water evaporated was measured in a tank provided with a heavy float connected through a fine chain to an index showing the water level on an exterior scale, divided decimally. By weighing water out of the tank, its capacity was found to be 5,172 pounds of water between the limits employed.

A complete record was kept of the coal, water, steam pressure and various temperatures, and the quality of the steam was tested with a calorimeter at frequent intervals. The proprietors of the mill took the proper business precaution of stationing observers at each point, who kept entirely independent records, agreeing with those taken by my assistants. The coal used was clean nut coal from the Lackawanna region. It had been exposed to the weather during the winter, and when first taken from the pile was wet, but a sufficient quantity for the trial was brought under shelter a few days in advance, so that the coal actually used was bright, and appeared dry. The results of the trial are as follows:

Average steam pressure	71.63
Average temperature of fire room	44.00
" " of water in feed tank	90.47
" " of water entering boiler after passing through a heater in flue	110.59
" " of up-take boiler No. 1 by pyrometer, (evidently wrong)	381.87
" " of flue beyond feed water heater	453.23
Wood used in starting fires, 730 lbs., equivalent of coal, (730×.4)	292 lbs.
Coal put in furnaces during experiment	19,827 "
Total of above	20,119 "
Combustible in refuse at close of experiment	820 "
Total coal consumed, including equivalent of wood	19,299 "
Refuse from coal removed during experiment	749 "
Refuse from coal at close of experiment	2,134 "
Total	2,883 "
Actual percentage of refuse, (2,883÷19,299×100)	14.94 per ct.
Combustible consumed, (19,299−2,883=)	16,416 lbs.
Coal with 12 per cent refuse agreed upon equivalent to that actually consumed [16,416÷(100−12)=]	18,654.5 "
Total weight of water actually evaporated at pressure of 71.63 lbs. from temp. 110.59°	161,573.28 "
Equivalent evaporation at pressure of 70 lbs. from temperature of 180°, as agreed upon	172,592.58 "
Evaporation per lb. of coal, with 12 per cent of refuse, at pressure of 70 lbs. from temperature of 180° F.	9.252 "

The difference of temperature between the walls enclosing the boiler and the surrounding air, was accurately ascertained by hanging a thermometer close against the wall, covering it with a woolen cloth, hanging another in the open air near it, and after 15 minutes or upwards, taking the readings. The results from different parts of the walls of the double boiler were as follows:

	Sides.			Rear.	Felting on top.	Cast-iron front.	Thin panels in front.
Temperature of wall, degs. Fah.	52	65	78	92	78	73	Too hot for range of thermometer.
Temperature of air opposite	41¼	50½	55½	59½	67	47½	
Difference of temperature	10¾	14½	22½	32½	11	25½	?

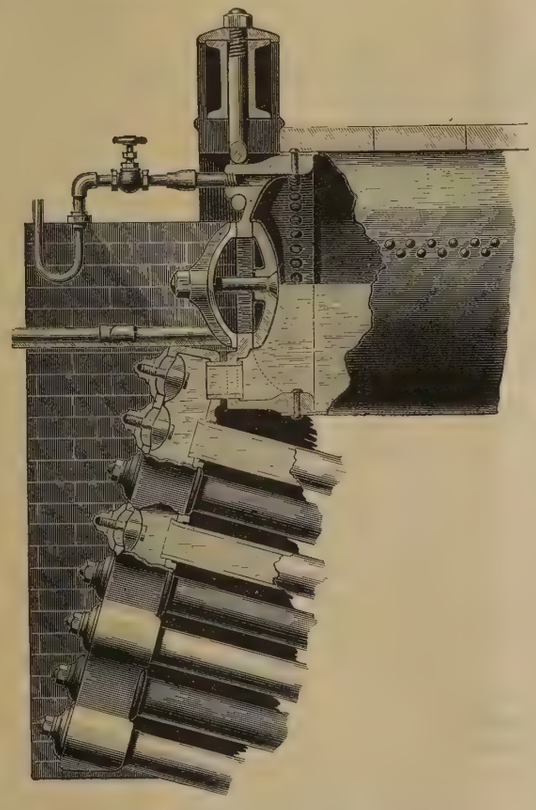


Fig. 3.—Side View of Up-Take and Connections.

Fig. 4.—Front View of Up-Take.

CALORIMETER TRIALS.

The calorimeter consisted of a simple barrel set on a platform scale. The scale beam was graduated for half pounds only; but by applying thereto an extra movable weight, one-10th that of the other, carefully levelling the platform, and in weighing bringing the end of the beam just clear of the ground, it was possible to read to one-10th, or even .05 of a pound. In an inclined position, through the side of the barrel, was fixed a thermometer graduated to ¼ degrees, and readily read to ½ degrees. A small iron propeller on a vertical shaft was arranged in the barrel. In operating, the barrel was nearly filled with cold water, which was heated with steam, when the increase in weight showed the weight of steam taken from the boiler, and the increase in temperature measured the quantity of heat in the steam. The steam was taken from the boiler near the issuing current, through a 2-inch pipe reduced outside of the boiler to ½ of an inch, and again near the outer end by an inserted nipple to $^5/_{16}$ of an inch, substantially on the plan recommended in a previous article on the subject.* To the end of the steam pipe a short piece of hose was connected through a valve; the pipe was carefully fitted, and was heated previous to each experiment by wasting steam through it before putting the hose into the calorimeter. The end of the hose was perforated in several directions, to avoid the jar due to the condensation.

Seventeen experiments were made during the day; one was rejected, in which the thermometer scale was seen to move by bringing the hose too near the instrument. The results were calculated from the records of the remaining experiments, on the following basis:

Let W=original weight of water in calorimeter.
Let w=weight of water added by heating with steam.
Let T=total heat in water due to the temperature of the steam at observed pressure.
Let H=total heat of steam at observed pressure.
Let l=latent heat of steam at observed pressure.
Let t'=total heat in water corresponding to initial temperature of water in calorimeter.
Let t=total heat in water corresponding to final temperature of water in calorimeter.
Let E=heating efficiency of the steam furnished, compared with saturated steam between the same limits of temperature.
Let Q=quality of steam explained hereafter.

$$\text{Then } E=\frac{W}{w}\left\{\frac{t'-t}{H-t'}\right\}.....(1)$$

The value of E was ascertained by the formula separately for each experiment. The average value was 99.16, showing that the steam lacked but $^{84}/_{100}$ of one per cent of the quantity of heat required for producing perfectly dry or saturated steam between the same limits of temperature.

The heating efficiency E is not the same quantity as Q, used to represent the quality of the steam in the Centennial report on boilers, as any deficiency of heat occurs entirely in the latent heat. (See Report of Judges, Group XX., Centennial Exhibition, page 138). The value of Q may be found directly from the following equation:

$$Q=\frac{1}{l}\left\{\frac{W}{w}-(t'-t)-(T-l')\right\}.....(2)$$

*See page 194 of our September number for 1877.

or, from the average of the heating efficiencies, by the following:

$$Q=1-\frac{(H-t')(1-E)}{l}.....(3)$$

Then when $Q<1$, percentage of moisture in steam $=100(1-Q)$.

When $Q>1$, number of degrees steam is superheated $=2.0833\ l\ (Q-1)$.

In the present case $Q=.98955$. Percentage of moisture in steam $=1.045$ per cent.

This is practically dry steam, and equal in quality to that furnished by boilers of any type not provided with superheating surface.

The experiments show in a gratifying manner that you have succeeded in overcoming a great difficulty often experienced with boilers constructed of a combination of small chambers to reduce the danger of explosion. The deficiency of ordinary boilers in furnishing dry steam is little known, from the fact that a large proportion of moisture may be worked through an engine without causing noise or other external indications, though the economy is materially effected.

The preliminary trial of engines gave the following results:

Duration of experiment	4.1 hours.
Average steam pressure in boilers	93.94 pounds.
Average vacuum in condenser	21.5 inches.
Average revolution of engine per minute	64.492
Water evaporated per hour	8830.244 pounds.
Average initial pressure in steam cylinders	84.425 "
Mean effective pressure in cylinders	30.1275 "
Average point of cut-off	.129 stroke.
Average indicated horse-power (both engines)	292.613
Maximum horse-power shown by a complete set of diagrams	315.580
Water per indicated horse-power per hour	30.177 pounds.

The pressure by diagrams at the point of cut-off was 12 to 16 pounds less than the initial pressure, and the vacuum in the cylinders rarely exceeded 10 pounds. The pipe connecting the boilers and engines was 131 feet long, and in its course crossed a passage 43 feet wide between the buildings. The pipe was covered with one of the forms of felting applied in the plastic state, and in the external air was closed in a box packed with wool. The vacuum was less than usual on the day of the trial, caused by some derangement of the cones of the condenser. This difficulty was aggravated late in the experiment by the partial giving way of a joint on a cylinder head. On the whole, the conditions were not favorable for the economical development of power in the engines. It is, in fact, popularly supposed that this class of engines develop a horse-power for $\frac{2}{3}$ the quantity of steam required in this case.

The duration of the boiler experiment was 12 hours and 37 minutes, of which fully 13 minutes were necessarily lost in starting and hauling fires. On this basis the water was evaporated in 12.4 hours, or at the equivalent rate of 13,919 pounds per hour for feed water at 180 degrees. On the basis that any good engine under fair conditions will require but 30 pounds of water per horse-power per hour, your boilers, during this experiment, though not forced to their utmost, developed, under condition agreed upon

$$\left\{\frac{13919}{30}=\right\}$$ 464 horse-power, or 104 horse-power in excess of the guaranteed power.

In accordance with your request to briefly discuss the results of the experiments, it may be stated that the coal required per horse-power per hour is evidently dependent in any case upon the economy of the boiler and engine jointly. With an evaporation of 9.252 pounds of water per pound of coal, and 30 pounds of water per horse-power in the engine, there would be required per horse-power per hour 3.24 pounds of coal. This boiler performance, however, is rarely obtained in ordinary practice, so generally a low cost of power in fuel is due to using an excellent engine with a fair boiler. For instance, during the official trial of one of the most prominent pumping engines in this country, the boilers, which were specially designed to secure economy, actually evaporated but 8.31 pounds of water at a pressure of 89.4 pounds from a temperature of 100° per pound of Cumberland coal; yet the engine was so economical that there was required but 1.69 pounds of coal per horse-power per hour. The equivalent evaporation of your boilers from the same temperature with anthracite nut coal, much inferior to Cumberland, on the basis of the trial above mentioned, is 8.547 pounds of water per pound of coal; so if your boilers were used in connection with that particular pumping engine, there would be required but 1.64 pounds of coal per horse-power per hour.

The economical performance of your boilers could undoubtedly be rendered still greater by reducing the rate of evaporation. The more fuel burned per square foot of heating surface in a given time the greater the quantity of heat lost in the chimney, so that, within certain limits, using proper proportions, the economy increases as the rate of evaporation is diminished, though in a much less ratio. To accomplish this result fully, however, the boiler would probably need to be so proportioned that it would not develop a maximum of 464 horse-power, or upward, as in its present form. Very truly yours, Chas. E. Emery.

International Exhibition in Australia.

We have received the announcement of the great World's fair to be held at Melbourne, Australia, in 1880 and 1881, from which we learn that the exhibition will be opened October 1st, 1880, and remain open until March 31, 1881, in buildings erected for the purpose, to be paid for by the funds provided by the colonial government. The latter has invited the British, foreign and other colonial governments to take part, reminding them that since 1851 Australia has been represented at all the great exhibitions, and invites now a return of the compliments paid her; reminding them at the same time that the increase and present high standing of Australian commerce justifies them in inviting the great manufacturing countries to send the most complete products of their skilled industry, as the Australians are in a position to become good customers, and also as they naïvely add "generous competitors."

Applications for space are requested to be made not later than June 30th, 1879, while the prospectus sent (which by the way is a very fine specimen of the typographical art) contains regulations which are framed after those of our own exhibition, but containing what we consider several improvements.

We wish our Australian friends all the success they so fully deserve for so creditable an enterprise.

Building Intelligence.

NEW YORK CITY.

IMPORTANT PROJECTED BUILDINGS.

Seventy-sixth st, near 3d av, workshop, 28x100 ft, four stories; cost, $15,000; E. T. Hatch, owner and builder. Fifty-sixth st, near Madison av, three first-class dwellings, 22x56 ft; cost, $22,000 each; S. L. Bradley, owner; M. C. Merritt, architect. No. 195 Prince st, tenement, 25x63 ft; cost, $10,000; G. Rauchfuss, owner; J. B. Snook, architect. No. 10 State st, tenement, 30x64 ft; cost, $13,000; brown stone front; P. Dollard owner; J. Correja, architect; Terrance Kiernan, builder. Fifty-ninth st, near 9th av, two flats, 25x76 ft; brown stone fronts; cost, $12,000; Thos. Tracy, owner and builder; F. G. Barns, architect. Forty-seventh st, near 8th av, tenement, 25x78 ft; five stories; cost, $10,000; F. Buse, owner; J. H. Valentine, architect. No. 60 West 54th st, first-class dwelling, 25x60 ft; cost, $25,000; J. G. Lynd, owner, architect and builder. No. 110 Sullivan st, tenement, 34x80 ft; five stories; cost, $15,000; J. Hapke, owner; John M. Forster, architect. No. 375 Broome st, 25x83 ft; flats; cost, $12,000; Lorillard estate, owner; J. B. Snook, architect. Nos. 52 and 64 Grove st, two tenements; cost, $10,000; brown stone fronts, 25x80 ft; C. K. Reeker, architect. Sixty-third st, near 5th av, four first-class dwellings, 25x65 ft; cost, $25,000 each; N. A. Williams, owner; D. & J. Jardine, architects. Nos. 113, 115 and 117 Fulton st, and 52, 54 and 56 Ann st, first-class store, 50x119 ft, five stories, iron front; cost, $50,000; A. C. Downing, owner; W. H. Smith, architect; A. G. Boyer & Bro., builders. No. 109 Greenwich st, tenement, 27x80 ft, six stories; cost, $12,000; E. Burke, owner and builder; W. Grant, architect. Nos. 413 to 417 East 116th st, three first-class dwellings, 20x55 ft; cost, $11,000; R. S. Mills, owner; J. P. Shipton, builder. Sixth av, near 62d st, four first-class dwellings, 19x50 ft; cost, $12,000; M. Kennedy, owner; J. C. Burne, architect. Fifty-seventh st, near Madison av, first-class dwelling, 18x65 ft; cost, $17,000; J. C. Rowe, owner; D. & J. Jardine, architects. Sixty-eighth st, west of Madison av, four first-class dwellings, 22x60 ft; cost, $18,000; R. McCafferty, owner; R. W. Buckley, architect. One Hundred and Sixty-ninth st, near 9th av, pavilion of St. Vincent's Hospital, 55x30 ft; cost, $10,000; William Schickel, architect. Seventy-second st, near 4th av, two first-class dwellings, 25x60 ft, four stories, brown stone front; cost, $17,000; Arnold & Constable, owners; Wm. Schickel, architect; adjoining, five first-class dwellings, 20x60 ft; cost, $14,000. Twelfth av, near 135th st, pavilion to residence of Oswald Ottendorfer, 26x42 ft; cost, $30,000; Wm. Schickel, architect. No. 141 East 16th st, flat, 34x89 ft, brown stone front; cost, $20,000; T. E. Tripler, owner and builder; Tirbil & Berger, architects.

GENERAL BUILDING NOTES.

The old Abbott House, at Hartford, Conn., is to be replaced by a new cottage.

William R. Travers is to build at Newport, R. I., a two-story cottage, 32x36 feet, on Bath road. The first story will be of brick, and the second of wood.

At Newport, Ohio, E. R. Randen is to erect a one-story brick dwelling, costing, $800. John Stemler is to erect a two-story brick dwelling; cost, $1,500. Adam Ebert is to erect a one-story brick dwelling; cost, $600.

George H. Helmle, architect, has completed plans for two dwelling houses, to be built on the corner of Sixth and Edwards streets, Springfield, Ill. The houses will contain nine rooms, laundry, etc., and will cost $3,700 each.

At Philadelphia, Messrs. J. C. Sidney & Son, architects, have furnished plans for a stone mansion to be built for W. Dawson, Esq., by Mr. J. Caldwell, on a lot of fourteen acres, on Chelten Hills, formerly part of the Jay Cooke estate. The house will consist of seven rooms and a hall 16 feet wide, on the first floor, and eighteen bed chambers and four bath-rooms on the upper floors. It is to be three stories high, covered by a hip roof with large dormers. The cost will be about $30,000.

After May 1st, the Phœnix Building on Court street, in Brooklyn, N. Y., will be torn down to give place to a seven-story building, in which there will be a total of 105 rooms. It will be of brick, in the Elizabethan style of architecture, and the finish will be of Dorchester stone. The architect is Mr. E. L. Roberts, and the gentlemen composing the building committee are Mr. William M. Thomas, chairman; and Messrs. A. B. England, J. H. Frothingham and J. B. Woodward. The estimated cost of the new building is $100,000, and it will be ready for occupancy on May 1, 1880.

Messrs. W. C. Kingsley, Abner C. Keeny, and Judge Alexander McCue, the owners of the site of the burned Brooklyn Theater, in Brooklyn, N. Y., have decided to rebuild the theater on the same spot, and plans are now being perfected by the architect. The new theater is to have its stage entrance where the main entrance formerly was, and in which so many perished on the night of the fire. The main entrance is to be made in Johnson street, with a front of 70 feet. The plans are to contain many provisions for the safety of the audience in the event of fire. Work on the new theater is to be commenced in a short time, and it is to be completed by the spring of 1880. The name has not yet been selected. There is an aversion to using the old name. The old theater cost $197,000, land included; the new building is to cost over $100,000.

Steam Pumping Engines.

Various kinds of highly improved steam pumping engines have for some time been manufactured and introduced among those needing them, by the Philadelphia Hydraulic Works, situated in Evelina street, east of 3d, below Walnut, Philadelphia, Pa.

We give on this page representations of some of the most prominent of these engines. Fig. 1 represents what the manufacturers call a marine pump, but which we would rather call a universal pumping engine, as it pumps hot and cold liquids, is adapted for raising water for water works, for mining purposes, for steamships, as boiler feeders, fire engines, etc., while in addition to all this, by the removal of the key from the cross-head, the pump is at once changed into a complete and perfect steam engine, adapted to drive all kinds of machinery, such as rolling mills, fan blowers for blast furnaces, etc.

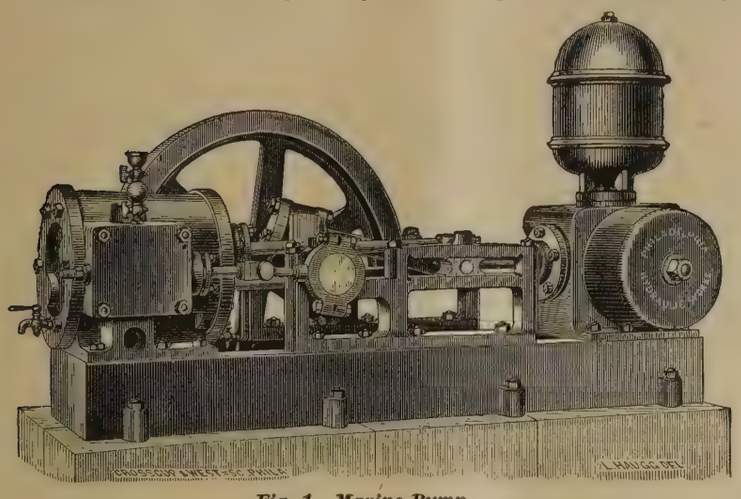


Fig. 1.—Marine Pump.

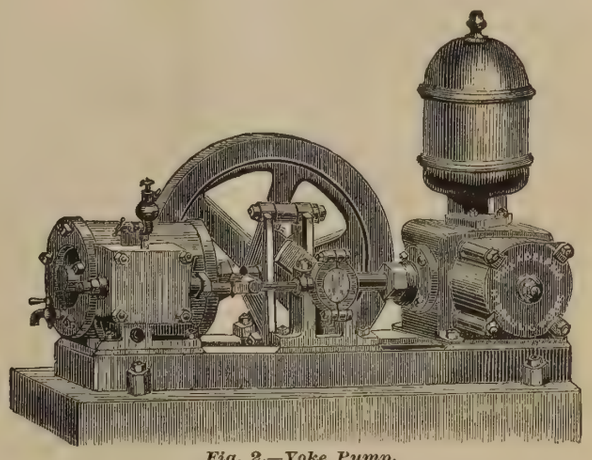


Fig. 2.—Yoke Pump.

This pump, therefore, a combined balance wheel steam pump and steam engine, has been used for years in large iron works and sugar refineries, and combines three important essentials, namely, simplicity, durability, and efficiency. It is so simple in its construction, that any ordinary mechanic can readily understand it. All its working parts are of massive proportions. The cranks and connecting rods are made of cast-steel, the glands of brass, and the wrist pins of the

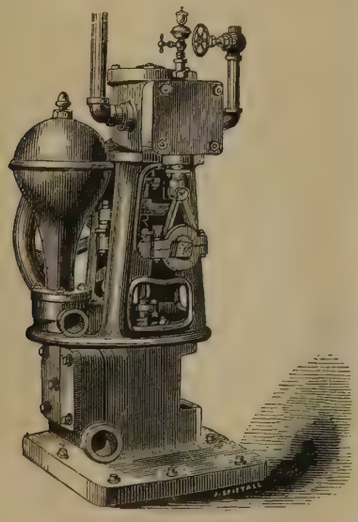


Fig. 3.—Upright Pump.

crank of the same size as the journals. An ordinary flat slide valve on the engine is so set that the crank passes its center easily, allowing a motion as slow as two revolutions per minute. It is double acting, heavily brass lined, and water piston packed with either hemp, leather, or metallic rings. The piston and piston rod, the valves, both suction and delivery, and the valve box are all of brass. The arrangement of the valves, the facility with which they can be taken out and replaced, and their construction, are considered by good judges of pumping engines superior to any other. Various improvements have been made; the valve chest is now made of brass instead of iron, is in one casting, and secured by five bolts instead of one as heretofore. The bed plate and connecting rod are now longer than formerly, causing much less wear on the crank shaft, and a brace running from the steam to the water cylinder adds materially to its strength and durability. Being so eminently reliable, it is especially to be recommended in cases where the least failure to perform its duty would involve great danger; such cases are the pumping out of steamships, mines, etc., while the price, considering the work performed, is remarkably low, as the cost of the pump and engine combined, does not exceed that of another engine alone, the cost varying from $375 to $1,500, while some sixteen sizes are made between these limits, the smallest pumping 1 gallon for every 3 revolutions, the largest 30 times as much, while larger sizes are made to order.

Fig. 2 represents the yoke pump, which is also double acting. It differs from the former only in the substitution of the yoke for the connecting rod, cross head and guides. With the yoke attachment the pump and engine are brought nearer together; it is less expensive, and for many uses equally as good. In case of fire, or any emergency, it can be run at a high speed, and force large quantities of water without any fear of a break down or a dead lock between the pump and the steam engine. Like the marine pump, it can be used for driving other machinery. The diameter and face of the balance wheel will be changed to suit. Larger sizes are built to order, while, if desired, they are made of brass. The manufacturers also put, in place of the water cylinder, a ball valve pump. This pump, with the yoke attachment, is preferred to any other for pumping coal-tar, molasses, mash, paper pulp, and semi-fluids.

Fig. 3 represents a vertical pump, which is also double acting. The water piston is packed with either hemp, leather cups, or metallic rings. Its merits are compactness, strength, and easy access to all the working parts, which are essentially the same as in the marine pump. It is made with suction and delivery openings at each side, so as to make connections conveniently. These pumps cost from $300 to $600, according to size.

Fig. 4 is a belt pump for feeding boilers with either hot or cold water. Having no steam engine attached, but only requiring a belt from the shafting, its price is about one-third of that represented by Fig. 3; notwithstanding this it is complete in itself, with wrought-iron crank shaft, connecting rod, fast and loose pulleys, metal valves, and boxes fitted up in the best manner. They give the best results, with 40 strokes per minute.

This company also manufacture small steam fire engines, adapted for use in towns and villages, and of which the weight, cheapness, and simplicity of construction are a strong recommendation. They weigh about 4,000 pounds, ready for service. Though simple and unpretending in design, they are constructed in the best possible manner, and will be found reliable in an emergency. In towns where large and expensive engines are not required, and in manufacturing establishments far removed from fire stations, these engines will be found convenient and serviceable. Larger sizes are built to order, and we are authorized to state that the manufacturers are prepared to furnish hydraulic presses of any size and power required, and are always pleased to receive suggestions from customers in regard to extra finish and ornamentation.

Fortifying the Sub-Treasury.

In addition to what we published on page 250 of our November number for 1878, regarding the new vault for the Sub-Treasury at the corner of Wall and Nassau streets, in this city, we give the following details respecting the alterations that will be made to the building, to make the great vault impregnable against all attacks, from whatever source:

Every window on the Nassau street side—numbering exactly two dozen, exclusive of openings in the basement and beneath the broad flight of marble steps, will be heavily barred, reminding one of a prison or insane asylum, while those of the upper story will be provided, in addition, with Machicoulé's bullet-proof shutters which are constructed in such a manner as to admit of swinging out from the building, there to be held fast at any desired angle, as a sort of shield, or screen, from any external missile. These will be pierced for musketry, to enable the inmates of the building to command the street. The gratings to the windows, coal vaults, etc., will consist of iron and steel bars welded together. Being made in alternate layers, the bars and iron plates will afford the most effective resistance to the assaults of a mob, or to burglars' tools. The iron would hold fast, even should the steel be fractured while the latter could be drilled or sawed off only with the greatest difficulty. In addition to the means of defense, as above described, there will be

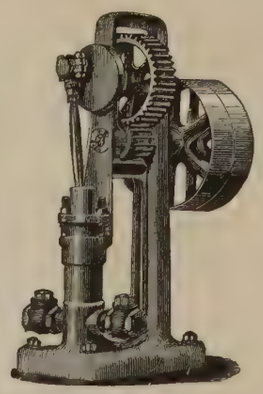


Fig. 4.—Belt Boiler Feeder.

three circular iron turrets on the roof, each 6 feet in diameter, pierced for musketry like the shutters below. The plates will be ¾ inch thick, and the bars for the gratings will be 1¼ inches in diameter. The plans were prepared by the United States Engineer Corps, and are being executed under instructions from the Treasury Department. The appropriation is $15,000.

What We are Doing in Iron and Steel.

We find the following excellent article on our iron industry, as compared with that of England and Germany, in the New York *Sun:*

One of the most important industries of the country, and one which promises to attain under the brighter skies of the present year even greater proportions than it now has, is the iron trade. While in England the iron business was greatly prostrated last year and continues to be in a state of extraordinary depression, bringing hardship and suffering to many thousands of operatives, its condition in the United States in 1878 showed an encouraging improvement over 1877, and the prospects of 1879 are hopeful.

Mr. James M. Swank, the Secretary of the American Iron and Steel Association, reports that our founders have no present fear of foreign competition. The iron manufacturers of England, indeed, have reluctantly given up the United States market as hopelessly lost, and this loss has greatly helped to depress the industry in that country and to increase the gloom which rests over its future. Whereas our imports of railroad bars amounted in value to nearly twenty millions of dollars in 1872, in 1878 they fell off to the insignificant sum of $530.

The London *Iron*, the organ of the iron and steel trade, acknowledges that our existing plant for making Bessemer steel is "far in excess of possible requirements, and that as iron rails are now almost entirely superseded by steel, it follows that English railmakers have lost one great customer." Its only hope is that "the agricultural population" will arise in its might and take away the tariff on iron and steel, thus refusing "to submit to the domination of Pennsylvania and the textile manufacturing States which support her as a matter of course." It therefore urges the "American free traders to close up their ranks and stump and pamphletize the country if they wish to release the agriculturists from the bondage in which they are held." We do not, however, discover any indications that such a movement is at present in progress in the country.

The statistics of the iron trade of the United States show that our production of pig iron in 1878 was 2,382,000 tons, against 2,314,585 tons in 1877, though there were sixteen fewer furnaces in blast at the close of last year than at the close of 1877. This, of course, indicates that those actually at work produced more on the average than in the latter year; but the prices of pig iron are so low that many furnaces were run without a profit. While in both steel and iron rails there was an improvement, in pig and bar iron there was a decline from the exceptionally low prices of 1877, in the one case a decline of $1.50 a ton, and in the other of $2.24 a ton. The founders hope, however, that prices are at last at the lowest point to which they can fall, and anticipate a continuance of the increased demand which characterized the old year.

The manufacture of Bessemer steel made healthy progress during 1878, and the prospects for 1879 are very bright. The rapid development of this industry in the United States has put us in such a position that we are now independent of the rest of the world in the matter of steel, and foreign competition has no terrors for our makers. Like the rest of the iron men theyare satisfied with the present tariff, and ask no greater odds than they now have. Some of them even think they would not suffer were the duties lowered, and they share the conviction so generally entertained in England that the United States will never again be a valuable customer for the British manufacturers of Bessemer steel. The perfection of our steel furnaces has lately won favorable mention in Germany, where the steel manufacturers are clamoring for a protective duty, which, it seems likely, they will not fail to get, for they have Prince Bismarck on their side. Dr. Wadding, a well known German statistician, has ascertained that Prussia is so far behind the United States in steel making that while the latter, with twenty-two converters, produced in 1875 over 375,517 tons of steel, the former, with thirty-five converters in operation, only produced 284,591 tons, showing a production nearly double in our favor; and he ascribed our greater turn-out entirely to the superior mechanical appliances possessed by our works. In 1877 we manufactured of steel ingots 560,587 net tons, and of Bessemer rails, 432,169 tons. In 1878 the product was about 730,000 net tons of ingots and 600,000 tons of rails. This is a very handsome gain, and it justifies the cheerfulness which prevails among the manufacturers of steel. Putting the iron and steel rail production of the year together, the total amounts to 930,000 tons, a total only once exceeded in our history, and that in 1872, when the product reached a million. Even that immense manufacture will probably be equalled, if not exceeded, in 1879.

The last year, on the whole so encouraging for the future of our iron industry, was one of great disaster to that of Germany, and the present movement for protection in that empire largely springs from its misfortunes, which have been accumulating since 1875. Of thirty-two companies, whose united capital amounted to 78,000,000, only six paid any dividend whatever for the year 1876, and the aggregate accounts showed a loss of nearly $2,000,000 on that capital against a loss of about $1,000,000 in 1875. Since 1876 things have been going from bad to worse, and now, in the words of a writer in the London *Times*, the iron trade in Germany is in a state "worse, unquestionably, than that of any other country." The famous Krupp works at Essen, the largest in the world, employing two years ago 10,500 workmen in factory and 5,000 more in the mines and blast furnaces, have suffered heavily, while between April, 1873, and April, 1877, the number of workmen employed by twenty-two of the principal companies, exclusive of Krupp's, fell off from 27,700 to 14,600.

By a vote of the Reichstag on the 7th of December, 1875, all the duties on iron entering Germany expired January 1, 1877, and since then it has been the only European country, except Sweden and Norway, that has admitted free of duty the products of English mills and forges, and they have poured in quantities. The German founders are dissatisfied with this state of things, and with Prince Bismarck as their powerful ally they are working for a protective tariff, which, the prospects are, they will assuredly get.

Meantime the British Iron Trade Association is doing its best, through Lord Saulsbury, to defeat their efforts, but with little hope of success. How much Great Britain would lose by the imposition of protective duties on iron by Germany is shown by the statistics of her exports of iron to that country in 1877. That year Scotland sent her 127,355 tons of pig iron, and England 200,000 tons, while of English steel rails Germany took 21,365 tons.

World's Fairs in Australasia.—During the present year, and in 1880, international exhibitions on an extensive scale will take place in the colonies of New South Wales and Victoria, Australia. The dimensions of the former, which will be held at Sydney, New South Wales, this year, have not, as yet, been determined upon, and, in consequence of the shortness of time at the disposal of the promoters, there is no doubt but that it will be eclipsed in interest and magnitude by the one which will, it is anticipated, be opened at Melbourne, Victoria, by the Prince of Wales in person in June, 1880. For the conduct of this a Royal Commission of sixty-four persons has been constituted, and progress is already being made with the erection of the necessary buildings, with their annexes and enclosed courts, which will occupy over twenty acres of ground, contain nearly five hundred thousand cubic feet of space for the accommodation of the various exhibits, and will be constructed at a cost of $5,000,000 at the least.

A New and Reliable Packing for Steam Joints.

The unreliability of the packings for steam joints now in use is well known, especially in regard to their durability; therefore any improvement in this respect is very desirable, and we take pleasure in announcing a new kind of packing, chiefly consisting of a combination of rubber with plumbago, brush filings, etc., which the inventor calls "Usudurian" packing.

This packing is a non-conductor, packs any kind of steam joint, and is claimed to last longer than any other packing made. By using a little care in separating joints, the packing is not injured and can be used without change for a long time. Being applied in an unvulcanized state, it readily accommodates itself to any unevenness in the surfaces it is placed between. It does not ooze or squash out and separate from the rest of the packing, as is the case when putty joints are made. When steam comes in contact with this packing, it becomes vulcanized and of a metallic nature, in which state oil does not have that injurious effect upon it that it does on ordinary rubber packing. By the application of a little naphtha to the surface, two pieces of this packing can be put together, and under pressure become as solid as one piece. This point alone is valuable, as it makes it easy to give the packing any desired thickness. In many cases joints are uneven, and require building up on one side; by the use of naphtha any kind of a graduated joint can be made with comparatively no trouble or expense. By using Usudurian the time and expense of making ground or faced joints on locomotives and steam engines is obviated. As the unvulcanized Usudurian will not decompose, the scraps or waste pieces can be returned to the manufacturer at the regular price, less the expense of the sheeting. There are many other points of merit in this packing which engineers will readily appreciate.

We are glad to state that the manufacturers of this article have not labored under the difficulties of prejudice that nearly every article, however meritorious, is usually subjected to before it earns a place in the commercial marts of the world. Those difficulties were not experienced because this packing was at once placed into the hands of practical men, capable of judging for themselves, and who did not look to their neighbors for information when practical knowledge was required.

This material is not sticky under any circumstances, and joints can be broken in all cases without injury to the packing, providing some chalk is applied to one of the surfaces. After the packing has been heated by the steam for a short time and becomes set, the nuts must be turned up tight.

This packing is made by the Woonsocket Rubber Co., of 80 and 82 Reade street, New York, and 69 and 71 Pearl street, Boston, where a full line of sheet packing, man-hole and hand-hole gaskets are always kept on hand.

Among many letters of recommendation before us, we will only insert the following, dated New York, March 22, 1878, from C. F. Barrett, engineer of the steamer "W. E. Cheney": "After a trial of nearly one year, during which time not a single failure has occurred, I am satisfied that your packing excels anything I have ever seen. Out of some 150 persons using Usudurian, I have yet to hear of one failure where it has not done what is claimed for it, namely, reliability and durability. I have also used the Usudurian in stuffing boxes, and find that it is far superior to anything I have ever seen. We are allowed, and carry a pressure of 90 pounds of steam to the square inch. I cheerfully recommend it to any one using steam, and am confident that after one trial they will find it well worth using."

Constructive Carpentry.

CONTINUED FROM PAGE 59.

Roof Construction.—The construction and form of a roof is determined by various circumstances, such as the shape and nature of the building, the material with which it is to be covered, the prevailing taste of the locality, etc. We will here only speak of the construction of the frame-work, and give some illustrations in isomeric projections.

Fig. 1 represents the manner of connecting the beams at the lower end of the hip of a roof; the position of square and dotted lines show in which way the lines have to be drawn for mortising the joints in a proper manner, so as to make them fit in the right position; it is the same with Fig. 2, which represents the combination that may be made for the valley, so as to connect the parts at its base in a proper manner. Fig. 3 serves the same purpose.

It will be observed that in all these combinations the outward strain of the oblique beams is borne by the horizontal beams into which they are mortised. It is evident that the walls of a building cannot bear such strains, but would be pushed outward by the pressure of the oblique beams, hence some provision is necessary to relieve the walls from such a strain. In olden times it was exclusively done in the manner here indicated, while in very large buildings, such as churches, the walls were strengthened by exterior additions, such as buttresses, and in cathedrals by what were called "flying buttresses," which were nothing but inclined arches, leaning with their upper ends against the wall to be protected, for the outward pressure of the roof beams, or of an arch under the roof. At the present day, by the increasing use of iron, this protection is ordinarily provided by wrought-iron bars stretched across the building, uniting the opposite walls, and thus securing them against displacement by oblique pressure of any structure placed on top for supporting the roof.

The small bulk of such iron structures make them much more pleasing to the eye than the wooden frame-work, especially when the whole of it is made of iron, and wooden beams are entirely omitted. Several railroad depots, large warehouses, sheds, and also bridges, of which the whole frame-work is of iron, and which nowadays are found almost everywhere in this country, give beautiful illustrations of the proper use of iron for large structures; the arrangements here represented are however still used, and very appropriately, for smaller buildings, such as barns, stables, small warehouses, etc., where often economy of first construction is of great importance.

We recommend the study of existing iron structures to all young engineers and architects who have an opportunity to inspect them, reminding them to notice that in those of the better class the compressing strain is borne by hollow iron castings, while those bearing the extension strain do so by means of wrought-iron bars, rods, and girders. The great railroad bridges over the Ohio river at Louisville and at Parkersburg are beautiful illustrations of this principle, which is being more and more universally adopted as well for roofs as for bridges.

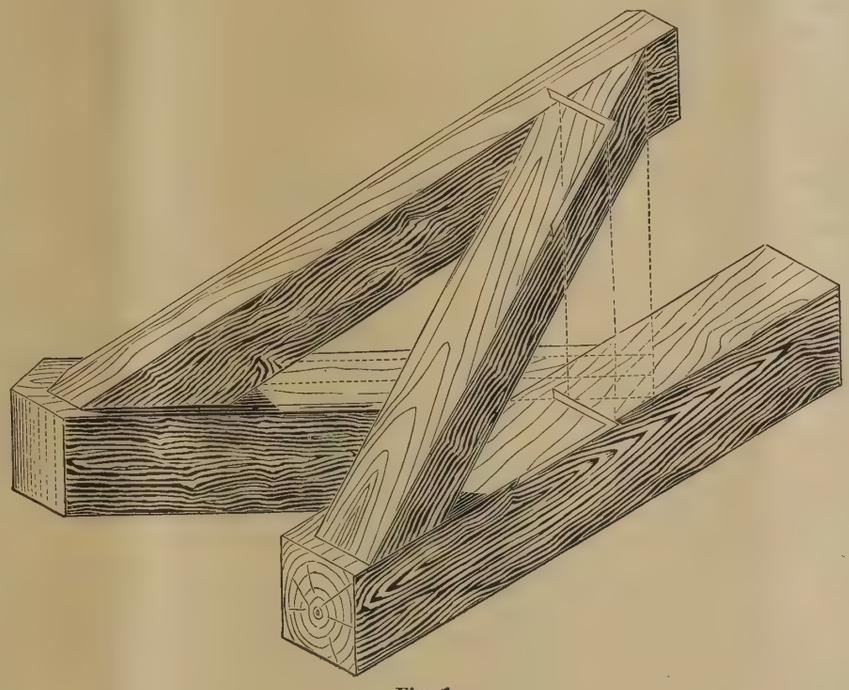


Fig. 1.

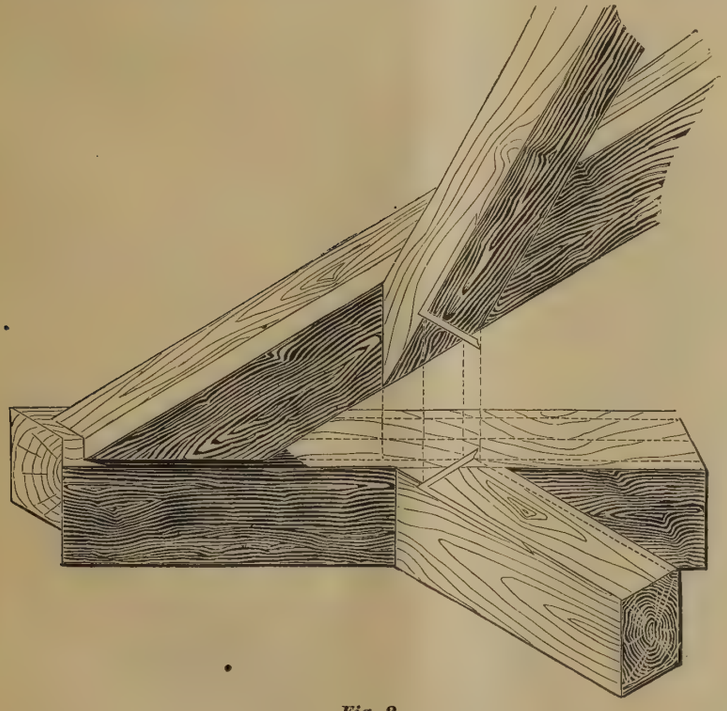


Fig. 2.

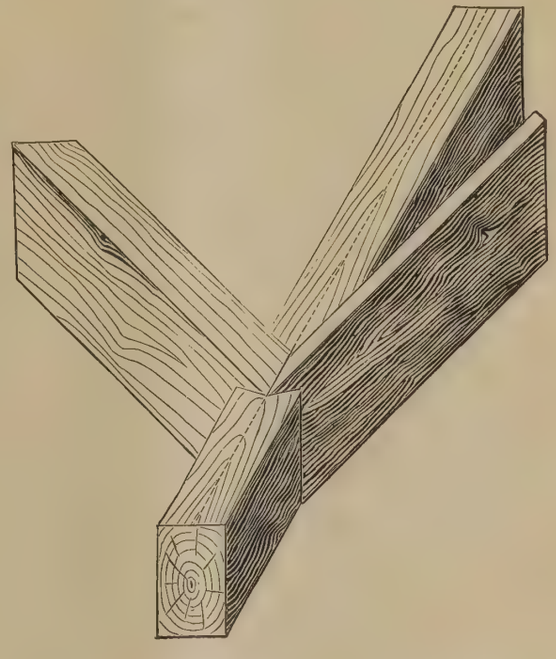


Fig. 3.

How to Get Rid of Flour Mill Dust.—A French process, designed to circumvent the perils traceable to dust in flouring mills, is thus described: The stones should be surrounded as completely as possible by a movable covering of wood or sheet-iron, which should have no opening in front but what is absolutely necessary for the work. In order to avoid the choking up of the ventilating pipes, it is necessary to provide special discharge pipes for the water, according as the stones are partly below or entirely above the floor. Again, the passages intended for carrying the dust should be placed underneath the stone, and beyond the point where the work is applied, regarding the direction of motion; it should have a breadth a little greater than that of the stone, and a depth of 8 inches, at most, for the largest stones, a sliding door serving to close it whenever dry dust is not produced. The water discharge pipe should also have a valve, which may be closed when water is not used, and when it is desired to carry off the dust produced when the stone is trued. If there are only four or five stones in the works, a single collecting pipe will suffice, and the blower should be placed at the end; but if there are eight or ten stones in one line, a second collector, 16 inches by 12, may be placed in the middle of the length of the first, and perpendicular to its direction. If, too, there are two long parallel rows, with eight or ten stones in each, they should also be connected with the second collector, or with a third, 16 by 20 inches, communicating with the ventilator.

Japanese Bronze.—The Japanese word corresponding to the English bronze is "karakane," which means "Chinese metal," whereas the brass alloys are called "shin-chu." The spelter for the latter is imported.

Boilers of Short Duration.

There are some boilers, which, from their defective design, must be short-lived. Such a one is the boiler of which the details and history are illustrated in the adjoined engravings, for which we are indebted to the Hartford Steam Boiler Inspection and Insurance Co., of Hartford, Conn. It was patented in 1871, was 8 feet long, 5 feet high, 3 feet 2 inches wide, and internally fired. The main defect in its design were the large flat sides, as seen in Fig. 1, which represents a perspective view of the right hand side of the boiler, with furnace door, and Fig. 2 shows the left side and rear of boiler; Fig. 3 represents the inner shell, while the outer shell is indicated by dotted lines. The large flat sides were secured by stays, and the result was necessarily that the sides puffed outward between the stays, like an over-stuffed mattress, and worked in and out like a bellows with the fluctuations of the pressure, until finally a sufficiently long and uniform furrow was formed inside, near the lower line of rivets, to allow it to open suddenly, like a door blown open by a gust of wind. Fig. 4 is a longitudinal section, and Fig. 5 a view in front, with furnace door, while

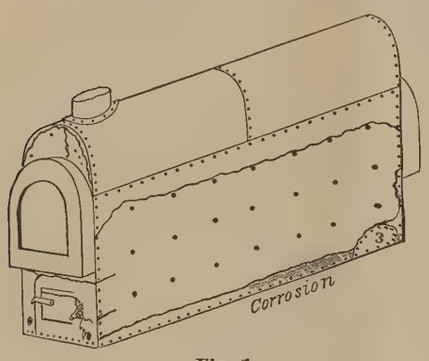


Fig. 1.

Fig. 6 is a cross section on the line A B of Fig. 4; Figs. 4 and 6 show the steam drum.

The boiler was located in a damp cellar beneath the laundry wing of a hotel, and was used for power and heating at a supposed pressure of about 20 pounds. It had the usual attachments, among which were a common lever safety valve and an Ashcroft steam gauge, which was attached by means of a short vertical brass connection screwed into the crown of the outer shell. On the top of the same was fixed a steam drum by means of two short flanged cast-iron pipes, as seen in Fig. 4, in which A is the curve of the flue, also seen in Fig. 6, which passes the gases and heat through the steam drum to the chimney. The whole hight of the boiler, with steam drum, (which is not shown in Figs. 1, 2, 3 and 5), was about 8½ feet.

It will be seen that the body of this boiler consisted of two similar shells, having semi-circular arched crowns, and fixed one within the other by means of one cast-iron frame or sill about 2½ × 3 inches, with through rivets, and (originally) forty-two screw stays arranged in three horizontal rows, seven in a row on each side, and also by a smoke connection riveted to both shells near the front end, so that the course of the

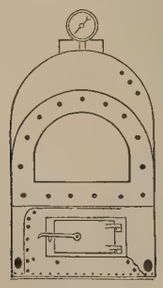


Fig. 5.

furnace gases seems to have been almost directly upward and through an elbow into the drum, thence to the chimney. Twenty-two tubes 2½ inches in diameter, and twenty tubes 3 inches in diameter, were set in the usual way in the heads of the inner shell, sloping 6 or 8 inches toward the back; the tubes were 7 feet 7 inches long, and located about 24 inches from the grate bars, (to the lower ones); the vertical rows were broken or staggered, so as to give the gases a zigzag

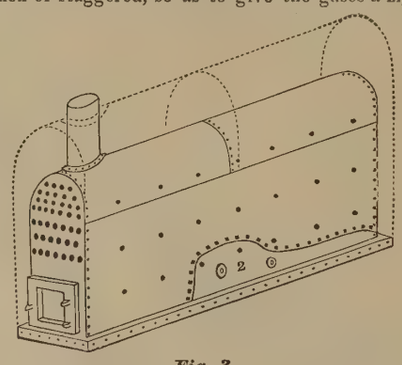


Fig. 3.

course upward through the cluster. The narrow chamber between the sides of the two shells and the tubes, extending from end to end of this hollow square, were filled with water, which also covered the inner crown. The iron of the shells was ¼ inch, the inner tube heads ⅜ inch, and the outer heads, which were only partly of wrought-iron, $^{3}/_{10}$ of an inch thick; cast-iron frames and bonnets corresponding in shape to a cross section of the cluster of tubes were fixed in, and formed the part of the outer heads opposite to the tubes.

The strain of the flat surfaces had gradually caused considerable damage, which had been repaired from time to time, and there were seven patches and eight new stays to be seen, as a part of such repairs, and another big patch was due, and might have saved the boiler for the time being if it had been applied on the day previous to the accident; but as it was, there was evidence of a line of old corrosion and several leaks for a distance of about 3 feet on the outer shell, on the back lower right hand corner from the small semi-circular patch toward the front (Fig. 1), and a number of radiating lines deeply corroded around the stays.

The practice of feeding very cold water at intervals,

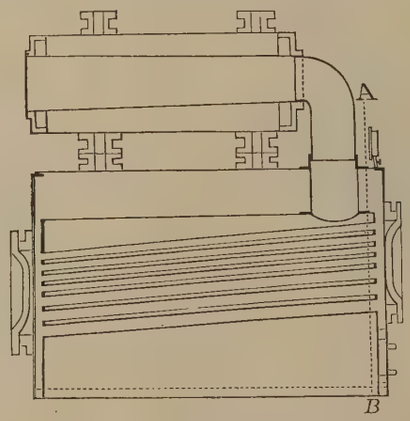


Fig. 4.

and suddenly, from the city water pipes, where a high pressure is maintained, and through a 1¼-inch pipe, must have chilled this part of the structure, where there could not have been a proper circulation to take the water up, and so uniformly cool the whole body of water within the boiler, must have greatly hastened the destruction of this very weak boiler. It will be seen, on reference to the sketches, that most signs of suffering are at the back end, where no fire ever acted directly to cause a proper distribution of the feed water. The hydrostatic test said to have been applied by the builder and patentee a short time previous to the explosion, no doubt was among the last, if not the final straw that broke the camel's back.

In our next we will illustrate and describe the results of the explosion, which might have been expected at any time of a boiler of so defective a design, and should serve as a warning to all who occupy themselves by inventing new designs for boilers.

Losses by Fires.

The losses caused by fires continue to be enormous in this country, the figures reaching a total that must surprise many people. During last year this loss amounted to $64,315,900, of which the insurance covered $36,575,000. For the four years from 1875 to 1878, inclusive, the total loss was $275,314,585, of which the insurance companies bore $147,674,700. The greatest destruction by fire of course occurred in this State, the leading one in population and in the number of its buildings. The loss last year was over nine millions, Pennsylvania coming next with over six millions, then Massachusetts with about five and a half millions, Ohio three and a quarter millions, and Illinois about three millions.

Of the establishments which are classed by the insurance companies as extra hazardous on account of their special liability to fire, due to the nature of the business carried on in them or to their construction of inflammable materials, the total number burned in 1878 was 5,229, valued at $42,557,200, and insured for $23,970,990. Thus though these "specials," so called in insurance parlance, were numerically a very small

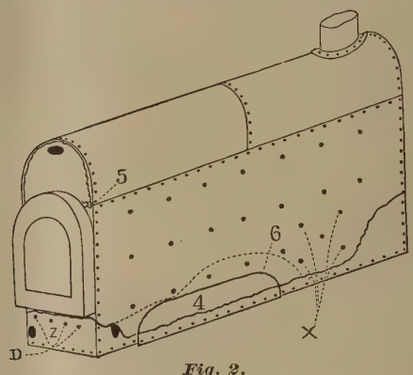


Fig. 2.

minority of the whole number of risks, the loss by them footed up to about two-thirds of the total losses of the year.

The establishments of this character, of which the largest number were burned in 1878, were the following; and the table is instructive as showing the kind of buildings most liable to fire:

Hotels	407
Grocery stores	375
Liquor stores	234
Drug stores	191
Gin houses	183
Saw mills	173
Restaurants	152
Livery stables	149
Flouring mills	115
Furniture factories	101
Blacksmiths' shops	82
Carriage factories	71
Bakeries	68
Ice houses	63
Carpenter shops	61
Churches	58
Lumber yards	58
Newspaper offices	56
School houses	54

The figures of the losses show that, extensively as

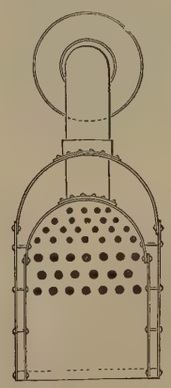


Fig. 6.

fire insurance policies are taken out, a large proportion of the property burned each year is still uninsured, and is an absolute loss to its owners, notwithstanding the comparatively low premiums, caused by the com-

petion of rival companies, which have reduced them to as low a figure as consistent with their solvency. They also indicate that the owners and tenants of buildings in more than usual danger from fire are not more ready to insure them up to their value than those whose property is subject to less risk. Thus, while the total loss on all buildings was $64,000,000, that on establishments in special danger was $42,500,000. The insurance on the extra hazardous was about $24,000,000, while that on the others was about $12,500,000. The total loss for the year not covered by insurance was therefore about $27,500,000.

While we have, especially in New York city, fires that destroy millions of dollars' worth at a single sweep, all the fires in Paris for a whole year do not destroy the value of one million. The amount destroyed there in 1878 by more than 2,000 fires, was only $835,000. In this connection we must recall the law in force in Paris, that the party on whose premises a fire originates, cannot recover his insurance. This has the effect of making every one in that city extra careful that at least the portion occupied by him is kept in a safe condition; while here sometimes a party who is well insured, when business is dull and prospects gloomy, may lock his place up in the evening with the hope that the whole concern may be burned up during the night, in which case the insurance money he will receive, is equivalent to a cash sale of his whole stock.

The Improved Microscope.

In ordinary compound microscopes the objectives and the eye glass are fixed at an unchangeable distance from one onother, and the enlarged image of the ebject can only be seen distinctly when the object is placed at a certain distance below the objective glass, so that the magnifying power is always the same when the same objective and eye glass are used. If the object is brought nearer to the object glass the image becomes larger and is thrown at a greater distance, so that in order to see it distinctly the eye piece ought also to be placed at a greater distance, which can only be attained by an elongation of the tube; at the same time we gain a magnifying power proportional to this elongation of the tube.

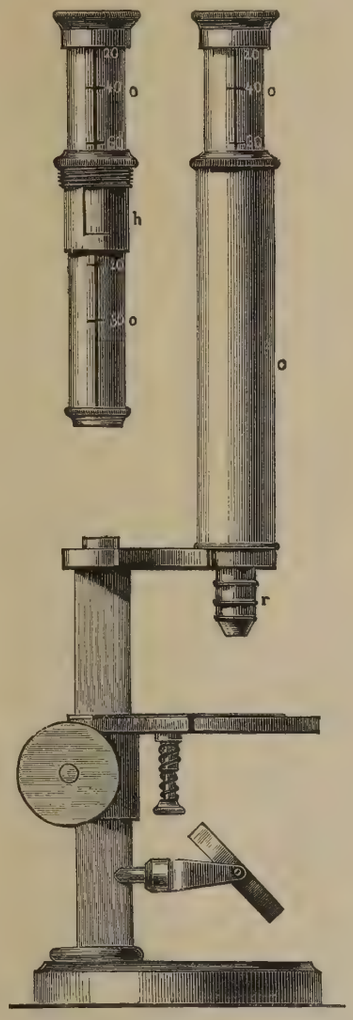
This principle was largely applied about a century ago, when microscopes were constructed of many feet in length—so long, in fact, that the object was entirely out of reach of the observer. This being very inconvenient, this method of enlargement was abandoned, and all the different degrees of magnifying power were obtained by a change of the eye pieces, and especially of the object glasses.

However, it is advantageous to use both methods of enlargement, and a very convenient arrangement is represented in our engraving, being what has been called in Germany the Pankratic microscope. As may be concluded from the preceding remarks, its peculiarity consists in a sliding tube containing the eye piece, by which its distance from the object glass may be changed, and thus various degrees of enlargement of the image obtained without change of glasses.

The objective consists of a combination of three lenses, seen in *r*. The eye piece is, as usual, attached to the top of the tube, but this is sliding, and represented separately at the left above, the tube *o* sliding into the piece *h*, which is screwed to the fixed tube C, which at its lower end carries the objective. The figures on the sliding tube indicate how much the enlargement is increased by elongation. Another improvement is usually attached to such a microscope, namely, an attachment for the reversion of the image.

The ordinary compound microscope shows the object reversed. This is for the reason that the image formed from an object by means of a lens system is always inverted, as may be seen in any photographic camera. For ordinary observations this is of no consequence, but it is very inconvenient when the object under examination has to be manipulated, as is the case when dissecting under the microscope, or when preparing objects. In order to correct this defect of inversion, an additional lens combination, similar to another eye piece, is attached to the lower end of the tube *o o*; the tube is then pulled out so far as to be almost above the inverted image, when the additional lens combinations attached to the tube *o o* will treat this image as if it were an object and form a second image in the tube under the eye piece, which image, being again inverted, will of course be right side up, and seen as such by the eye through the eye piece proper, when there will be no inconvenience in handling the object while being seen, as every change in its position will be seen in its correct place; without the provision described, any motion to the left will be seen as being to the right, any upward motion as downward, and *vice versa*.

Under the tube is seen the stage, on which the objects under observation are placed, and which may be



Pankratic Microscope of Oberhauser and Ploessl.

raised and lowered in order to bring the object at the proper distance from the lens *r*. At present, however, it is preferred to have this stage immovable, and the raising and lowering mechanism confined to the tube carrying the system of lenses, as then any manipulation of the object on the stage will not disturb the focal distance. Under the stage is seen the reflector, usually carrying on one side a plane and on the other side a convex mirror, which throws the light from below through the transparent object. In modern microscopes this mirror is so arranged that it can be moved sideways so as to obtain an oblique illumination, found necessary to observe fine details in objects, which by direct illumination are obliterated in a flood of light. For opaque objects this reflector is of course useless, but the light thrown on the object from above is concentrated to a focus by a convex lens.

Another important and very desirable improvement in the microscope here represented, is to make the stand movable on a joint, thus allowing it to be placed in an oblique direction, so as not to be obliged to always look perpendicularly downward, which is very fatiguing when working at a microscope for a long time. In fact, the arrangement here represented, notwithstanding it is that of two of the first makers in times gone by, (Oberhauser and Ploessl, of Vienna), is at present antiquated, and only interesting in respect to the history of the successive improvements in this important apparatus for scientific investigation.

Voting by Electricity.

A system of receiving and recording ballots, which is now in use in the French Chamber of Deputies, possesses so many advantages over the old methods, that it is even worth considering whether it or some similar system might not profitably be employed in Congress and the State legislatures. As every one who is familiar with the routine of their sessions is aware, much valuable time is lost by the slow and tedious taking of the votes of our legislative bodies, in calling for the ayes and noes. A large part of this time is saved in the French Chamber by the really beautiful electric system of automatic voting at present employed there. By means of it every member of the Assembly can see the progress of the ballot as it goes on, and foot up the results before they are proclaimed, since it collects the votes and totalizes them instantaneously. It also records them by permanent marks, and each deputy is able to see at once whether his vote has been correctly received and recorded. Thus there can be no false voting.

On each side of the chair of the presiding officer are placed two large cabinets divided into as many compartments as there are members of the Assembly. One of these cabinets is for the ayes and the other for the noes. Each deputy has a compartment for his "no" and one for his "aye." When a vote is to be taken, he touches one of two buttons on his desk, similar to those in use in hotels for the ringing of call bells, and drops a ball which records his ballot either for or against, according as he lays his finger on the positive or the negative button. A device is provided by which, as fast as the ballots are cast, their number is exhibited to the whole body, and the process of taking the vote of the French National Assembly, now composed of 750 members, is thus not only a rapid one, but is also such that every member can see at once how it is resulting. When the balloting is over, the apparatus is reset for the next voting by the turning of a crank.

But this machine does more than record the number of votes. By means of electro-chemical printing it writes them down as they are cast. The same current which causes the indicator to appear and the balls to fall, is made to print the name of each deputy and the nature of his vote on a paper register; and as this impression is lasting, a durable record of the vote is obtained. The color of the printing is in the one case blue, and in the other red, so that the ayes can be readily distinguished from the noes.

If it is desired to conduct a secret ballot, all that is necessary is to cover up the cabinets with blinds, and to substitute blank blocks in the printing presses for those bearing the marks of the deputies. The printing press, too, need not be limited to voting; it may be also employed in calling the roll and for similar purposes, and thus serve the convenience and save the time of members.

Of course the stupidity and bungling of some legislators would work against the success of so admirable and scientific a system of voting, but after a little experience with it they ought to learn how to use the machine, which would save them much time and trouble.

The inventors of this system are M. Guichenot, a civil engineer of Paris, and M. Clerac, the discoverer of the principle of the variable resistance of finely divided carbon under pressure—in fact, of the carbon button of Mr. Edison.

Scientific.

The Fitness of Women for Microscopic Researches.—We long ago advocated the fitness of women for microscopic investigations and for the preparation of microscopic objects. The delicacy of their hands and fingers, and their general familiarity with minutiæ, such as sewing and embroidering, make them as much adapted for microscopic researches as they are for watch-making, a business in which they are largely employed in France and Switzerland, while at present in Germany many manufacturers of microscopic preparations employ women, and their conscientious carefulness in this respect deserves all praise, which is proved by the admirable specimens reaching us through importers. The fact is, that it scarcely pays a microscopist to prepare the ordinary specimens himself, such as are used for teaching microscopic anatomy, histology, etc., as the most exquisite specimens are furnished by the trade at very reasonable rates.

Being satisfied of the fitness of women for this pursuit, we saw with satisfaction a letter from Elizabeth K. Churchill in the *Providence Journal*, which was the outcome of a visit she had paid to a meeting of microscopists, resulting in her conversion to the same opinion; we therefore give the letter in full. She writes:

"Not long ago I spent an evening with the section of the Philadelphia Academy of Science which devotes itself to microscopy. The attendance was not large, but all present, whether occupied in examining the objects prepared for study, through the several large microscopes on the table, or calling the attention of members to fresh specimens of their own, showed an enthusiastic enjoyment of their pursuit and a devotion to it like that which reformers give to a 'cause.' I had not expected to care much about the proceedings, because I lacked technical knowledge of this branch of science, but I shortly found myself deeply interested, especially when Dr. Hunt, whose name stands at the head of students of microscopy in this country, spoke eloquently of new processes of study, and consequently new interpretations of nature and ever-widening areas of knowledge. Dr. Hunt, as well as the President of the Academy, expressed an earnest wish that women would attend and take part in the meetings.

"There are several ladies in Philadelphia who are devoted to this branch of science, and I know of one in Providence. There are others elsewhere; but their number would increase rapidly if women of leisure knew the charm of exploration in that hidden world, in the midst of whose wonders we move unheeding. To study nature in any form adds fresh beauty and dignity to life; it develops a patient and reverent spirit, especially this division, so teeming with forms of marvelous beauty and delicate finish, a knowledge of which is so important to human comfort and safety. Few persons, even of the reading public, fully understand how much medical science, hygiene, and manufactures, as well as the branches of natural science, are indebted to the revelations of the microscope.

"Knowledge of the active but invisible world about us—the microscopic world—has, during the last quarter of a century, greatly increased, but its interest can never be exhausted; fresh fields of research are ever opening. Its study is a delightful pursuit for women of any age, and eminently suitable to them, as it can be pursued at home, is nice, and requires precisely the qualities of mind in which they excel—patience and attention to details, or exactness. Not many could receive pecuniary returns, but society is full of women who have money enough, but who are perishing in body and soul for lack of healthful, absorbing interests, yet are drawn neither to art nor practical philanthropy. To such, study with the microscope is earnestly recommended. To those who in any capacity have charge of the training of children, knowledge of any branch of natural science is invaluable, and this one is especially adapted to interest the eager minds to whom the world is new, and teeming with wonders. The dullest child would be quickened to interest by looking through a microscope of high power at a drop of stagnant water, and seeing great numbers of oval, transparent, gelatinous bodies moving swiftly about in it, like flies in the air, with a tiny forest faintly colored in two shades in the background; other forms, bacteria and vibros, also disporting themselves in it.

"Show a child the exquisite moth eggs called 'brindled beauties,' explain that even the air we breathe is full of living organisms, and you kindle in the young mind a flame in which coarse temptations are consumed. We need more elementary books of science; so simple as to be readily understood; so fascinating as to outrank the mischievous dime novels. Why should there not be dime stories of a higher order than those we deplore, having equal or greater charms? An enthusiastic taste for the study of natural history, acquired in childhood, would prepare the mind for the reception of moral truth and obedience to moral law. Children naturally observe the world around them, and only lose interest in it when their eager questions are met by ridicule or ignorance. Greater simplicity in dress, food and house-keeping, and economical use of the often wasted scraps of time, would enable many mothers, now obliged to chill the enthusiasm of their children by their own ignorance, to become their guides and companions in scientific study.

"The beginner in microscopic study will find Griffith and Henfrey's 'Microscopic Dictionary,' and Pitchard's 'Infusorial Life' good text books. The best microscopes are made in Boston and Philadelphia; those made by Zentmeyer, of the latter city, a German by birth, took the first prize at the Centennial Exhibition, and I was told that they are the best in the world; but am since assured that Mr. Tolles, of Boston, excels all other makers in objectives of very high power.

"Life would seem better worth living for if we gave more time to the observation and study of the material world, because we should learn humility, patience, and the great lesson that the universe is governed, not by caprice, but by inexorable law, with which our lives must harmonize, or we shall be miserable."

The Telectroscope Used for Photographing over Telegraph Wires.—One scientific novelty has scarcely astonished the world when another one of a not less startling nature is announced. The latest is the plan of M. Senlecq, of Ardres, to reproduce telegraphically at a distance the images obtained in the camera obscura. This apparatus is based on the property possessed by selenium of offering a variable and very sensitive electrical resistance according to the different gradations of light. The apparatus consists of an ordinary camera obscura, containing at the focus an unpolished glass, and any system of autographic telegraphic transmission. The tracing point of the transmitter intended to traverse the surface of the unpolished glass is formed of a small piece of selenium, held by two springs acting as pincers, insulated and connected, one with a pile, the other with the line.

The point of selenium forms the circuit. In gliding over the surface, more or less lightened up, of the unpolished glass, this point communicates, in different degrees and with great sensitiveness, the vibrations of the light. The receiver is also a tracing point of black lead or a pencil for drawing very finely, connected with a very thin plate of soft iron, held almost as in the Bell telephone, and vibrating before an electro-magnet, governed by the irregular current emitted in the line. This pencil, supporting a sheet of paper arranged so as to receive the impression of the image produced in the camera obscura, translates the vibrations of the metallic plate by a more or less pronounced pressure on that sheet of paper. Should the selenium tracing point run over a light surface, the current increases in intensity, the electro-magnet of the receiver attracts to it with greater force the vibrating plate, and the pencil exerts less pressure on the paper.

The line thus formed is scarcely, if at all, visible. The contrary is the case if the surface be obscure, for, the resistance of the current increasing, the attraction of the magnet diminishes, and the pencil, pressing more on the paper, leaves upon it a darker line. M. Senlecq thinks he will succeed in simplifying this apparatus by suppressing the electro-magnet and collecting directly on the paper, by means of a particular composition, the different gradations of tints proportional to the intensity of the electric current.

Readers who experience any difficulty in understanding the possibility of such a device, are referred to page 1 of our January number for 1871, where an illustrated description is given of a method to transmit drawings, portraits, and hand-writing by telegraph. The method there explained is one of the principles on which this new art—the transmission of photographic impressions—is based.

The Phoneidoscope.—An instrument with the above name was presented to the Societé Francaise de Physique at one of its late sittings, by the inventor, M. Taylor. Its object is to show, optically, the delicate particularities of sonorous vibratory movement. A thin film of liquid glycerin is formed like a soap-bubble film on a small opening made in a piece of blackened brass, and it reflects the light of a lamp in producing, either on the retina direct or by projection on a screen, the well-known iridescent effects of thin transparent plates. As long as the film is motionless the simple colors of iridescence are alone visible. But if, by means of a bent tube, the vibrations of a sustained sound are conducted underneath that film, by the voice or otherwise, the film begins to vibrate and the colors are distributed geometrically, producing on the surface fixed bands and moving rings, the disposition of which varies with the depth of the tone and the nature of the harmony accompanying it—that is to say, the pitch. M. Taylor showed, by projection, that the acoustic figures thus obtained become more and more complicated as the tone emitted rises, or when, the hight remaining constant, different vowels are pronounced. The colors thrown on the screen differed during the experiment in proportion as the film became thinner by evaporation, but the acoustic figures did not vary.

The results obtained are extremely varied and of curious appearance, according as apertures of different forms are used. M. Taylor projected the phenomena produced by triangular, square and round, by means of the Drummond light. The considerable heat that accompanies that process of lighting, causes, after a certain time, the evaporation of the film of glycerin, and terminates the experiment. But its duration may be augmented by passing the luminous rays through a glass flask filled with water, which deprives them of the greater portion of the qualities absorbable by the liquid glycerin.

We think that it would also be easy to protect the film by enclosing it in a bottle in which the air is kept saturated with watery vapor, as is done when repeating Newton's experiments with soap-bubbles.

Handling Melted Lead with the Bare Hand.—It is well known that when a metal is heated above red heat, which is about 1,000°, water will not touch it, but roll over it in drops; it will not even boil, but the drops will rotate around an axis, as if there were a repulsive article between it and the hot metal. The condition assumed by the water in this case is called the spheroidal condition; this is easily verified by pouring some water on the horizontal top of a red-hot stove, the only condition being not to put on so much at once as to cool the iron below 1,000°, when it will at once boil away. Careful observations have proved that such rotating spheroidal drops of water do not touch the hot metal, but that there is a perceptible space between, and that when the metal is allowed to cool gradually, the repulsion finally ceases, the drops of water touch the iron, boil, and at once disappear as vapor.

On this principle is based the surprising fact that the human skin can bear the touch of a white-hot me-

tal, the natural moisture in it causing a repulsion of the hot metal and the skin, so that they cannot actually come in contact, consequently it is possible to "ship" melted lead from a crucible with the naked hand, providing the lead is heated some 400° or 500° above its melting point, and the hand is not too dry, or the lead kept in the hollow of the hand long enough to cool below 1,000°, in which cases it would produce pain.

Some of the exhibitions of the so-called Fire Kings are based on this fact. Any one may move a white-hot iron rod over his tongue without danger of burning; while fire kings in addition harden their skin with such preparations as solutions of alum, tungstate of soda, etc.

We were reminded of these facts by an item recently going the rounds of the English and American papers, mentioning that the Prince of Wales was once standing with Dr. Lyon Playfair near a cauldron containing lead that was boiling at a white heat. "Has your Royal Highness any faith in science?" said the Doctor. "Certainly," replied the Prince. "Will you, then, place your hand in the boiling metal and ladle out a portion of it?" "Do you tell me to do this?" asked the Prince. "I do," replied the Doctor. The Prince accordingly ladled out some of the boiling lead in his hand without sustaining any injury.

Compressed Gas as a General Illuminator.—Compressed gas, the use of which for illuminated buoys was explained on page 33 of our late February number, may of course also be used for general illumination, and for this purpose its use is now being advocated by Mr. E. Schoenrock. He proposes to use it for railway cars, ferryboats, ocean steamers, and street lamps. The gas is made of fat, petroleum refuse, paraffin, or almost any oily substance, by simple distillation. The gaseous product of the distillation is conveyed into purifiers and thence into a large gasometer, where a freezing apparatus takes out all the particles of moisture, so that the gas is left perfectly pure and dry. It is next condensed under a pressure of 90 pounds in large cylinders, after which it can be transferred to any small reservoir. It can be carried in an iron cylinder about 6 feet long and 18 inches in diameter, which can be placed under the body of a car. This would contain compressed gas for 72 hours for one burner. The gas passes from the cylinder to the burner through a regulator, which serves to secure a perfectly even pressure at the burner under all circumstances.

It is claimed that gas made and used in this way will only cost one-fourth the price of common coal gas, and besides give much better light. The price of common gas is, on the average, 1 cent an hour per burner, and this compressed gas is claimed to cost less than ¼ of a cent per hour. We must confess that we cannot conceive why a gas requiring the additional labor of compression and the cost of apparatus to do this, should be cheaper than coal gas, which thus far has been considered the cheapest, and has held out for years, and is still holding out, against all competition—even against the electric light, so much boasted of. But we will see.

The Solar Spectrum as a Hygrometer.—Cornu has communicated to the French Academy some remarks upon photographs of the ultra violet portion of the solar spectrum, which go far to supplement the views often expressed on the importance of the spectroscope as an instrument for ascertaining the quantity of aqueous vapor present in the atmosphere. The purest sky of summer cuts out much more of the ultra violet rays than the purest sky of winter. The absorption at the violet end is general, or in broad bands, while at the red end it is selective, or in narrow bands; the absorption by vapor, which is but just beginning to condense, affects the violet end, while the red end is specially affected by vapor in a state approaching that of fog or cloud; the smaller the particles the less do they affect the red end of the spectrum.

As it would be out of the question to measure in this way the amount of vapor present in the atmosphere, such observations must rather be regarded as hygroscopic and not as hygrometric.

Working Steam at Higher Pressure.—It is well known that great efficiency in steam engines is obtained by an increase of pressure and the use of expansion. To accomplish this, the point lies not so much with the engine as with the boiler, engineers finding no difficulty in working an engine with steam at 150 or 200 pounds per square inch; therefore Mr. Walt, an eminent Liverpool engineer, thinks there is no practical limit to the working pressure. Some engineers will be inclined to differ with this opinion, as the management of steam used expansively in simple reciprocating engines at ranges of pressure much exceeding those named, is considered by many risky practice.

The Precious Metals.

Gold.—The only precious metals known from antiquity are gold and silver. Modern chemistry, however, has discovered several others, the peculiar qualities of which entitle them to be classed among the same group; while others, on account of their great scarcity and the labor of extracting them, cost more.

If we consider the qualities of metals truly valuable in regard to their industrial uses, iron stands at the head; it is therefore very fortunate for the progress of civilization that this metal—actually the most precious of all—is found in so very many regions of the earth in the most abundant quantities. If gold were as abundant it would be cheaper than iron, because it is unfit for the majority of purposes for which we use iron. It is too soft; even its alloys are inferior in hardness to bronze, copper and tin, while it cannot be welded together like iron, which, in fact, is the most wonderful of metals, considering the various forms into which it can be produced, such as hard spiegel iron, white and gray cast-iron, Bessemer iron, wrought and welded iron, cast-steel, cemented steel, chrome steel, tungsten steel, manganese steel, etc.

Gold, very unlike iron, is never anywhere present in large quantities, hence its extraction is always laborious and expensive. It is usually found in quartz veins between metamorphic rocks of all ages, and at the bottom of rivers in the sand washed from these rocks by the disintegrating action of the water. It is easily separated by washing, when by its weight it sinks to the bottom, while the lighter sand is carried off by the water over it. The use of mercury makes this process more economical, as the gold dissolves in the mercury, and thus extracts many particles from the sand which otherwise would escape. In order to obtain it from the auriferous rocks, they are finely pulverized in a stamping mill, while a little mercury is added; a continual stream of water carries the pulverized material from under the stampers, over an amalgamated copper plate, to which the gold amalgam adheres, while the water and sand are carried off. This gold amalgam is from time to time scraped from the plate, the excess of mercury pressed out, and the rest distilled off, when the pure gold is left as a porous pulp. At present, in our gold producing States, such as Colorado, this process is carried on in so rough a way that perhaps only half of the gold is extracted from the rock, while the other half is carried off with the washings to the creeks, where it is deposited on the bottom and awaits the persevering industry of future generations to extract it. It is well known that at present the refuse matter of some old German silver mines is being worked over by newly invented scientific processes, and more silver is extracted than the original miners obtained from the ore a century ago. The argument of the owners of the Colorado stamping mills, when we called their attention to this loss, was that they obtained gold enough from the ore to work it with a fair profit, and that they did not want to be bothered with new-fangled improvements.

The lustrous appearance of gold is well known; this is caused by its property of resisting any tarnishing influences. Its ductility is so great that it can be beaten out into leaves so thin that 250,000 piled up together are only one inch thick. Such gold leaves, when light is transmitted through them, are green, while, when heated to such a degree as to lose their metallic luster, this transmitted light is red as a ruby.

Gold is a good conductor of electricity, has a higher fusing point than silver, requiring very nearly 2,300° Fah. to melt it, while it is not acted upon by mineral acids, such as nitric, which dissolves silver. It is however attacked by any of the halogens, such as fluorin, chlorin, bromin, and iodin, or the acids of any of these elements. The most ready and usual solvent is a mixture of nitric with two parts of hydrochloric acid, which, by reason of its capacity to attack the king of metals, is called aqua regia, or royal water.

As pure gold is so very soft—too soft, indeed, for any practical purpose, it is alloyed with copper or silver, the first alloy producing a reddish color, and the second a pale yellow gold. Our gold coin, like that of France, Belgium, and Holland, contains one-tenth of both copper and silver, mostly copper. For jewelry the alloy differs with the quantity, and is estimated by what are called carats. A carat is the 24th part of any given quantity, thus when gold is called 24 carats it means that it is all gold; 20 carats means that of every 24 parts 20 are gold; 18 carats is the most common alloy used by jewelers, and keeps as well as pure gold; 12 carats is only half gold, and is a low alloy, which is apt to tarnish more easily and lose its luster, requiring more frequent cleaning.

The property of base metals, such as copper, to oxidize by heat, is made use of to refine gold; when it is kept melted in a crucible and exposed to the air, the gold will not oxidize, but the copper in it will, and the most ready way to dispose of this is to melt the gold in a cup made of bone earth, which possesses the property of absorbing the oxids of all base metals. Such a cup is called a cupel, and is placed in the muffle of a furnace called a cupelling furnace; being kept there until the tarnishing of the surface ceases.

To get the silver out of the gold it is melted with one-quarter of its weight of more silver; it is then cast, rolled out to a thin sheet, and exposed to the action of hot nitric acid, when all the silver is dissolved out, which does not occur when the quantity of silver is less, because then the small number of silver particles are so enveloped by the gold as to be protected by it against the action of the acid. Sufficient silver is present when the gold contains one-fourth of its own weight, therefore the process here described is called quartation.

Practically the most important solution of gold is that used for gilding by electro-plating. It is made by first dissolving the gold in aqua regia and removing the excess of the acid by evaporation. The salt is dissolved and soda added to neutralize the remaining acid, when an addition of cyanid of potassium causes the formation of a double salt of the cyanid of gold and potassium, which is the electro-plating fluid for the gilding bath.

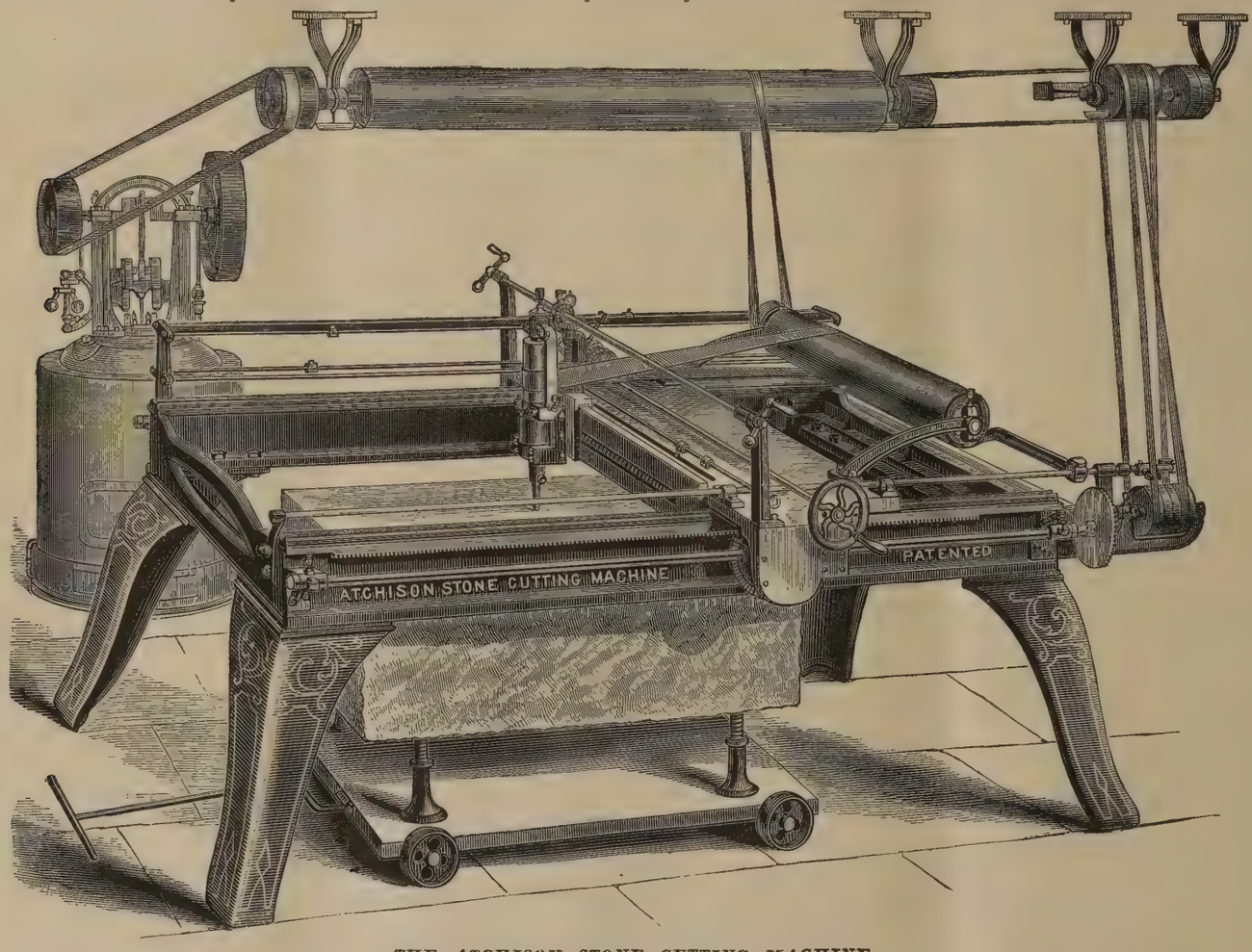
Value of Metals.—The following is an approximate estimate of the present cash value of the metals now known, rare and common. The rare metals have no market value, but they can be purchased at about the prices below. The price is given per pound, or 16 ounces avoirdupois:

Indium	$2,520 00	Silver	$18 72
Vanadium	2,500 00	Cobalt	7 75
Ruthenium	1,400 00	Cadmium	6 09
Rhodium	700 00	Bismuth	3 63
Palladium	653 00	Sodium	3 20
Uranium	576 58	Nickel	2 50
Osmium	325 28	Mercury	1 35
Iridium	317 44	Antimony	36
Gold	301 45	Tin	33
Platinum	115 20	Copper	25
Thallium	108 77	Arsenic	15
Chromium	58 00	Zinc	8
Magnesium	46 50	Lead	5
Potassium	23 00	Iron	2

Revolution in Stone Cutting.

The introduction of machinery for cutting and dressing stone will effect a total revolution in that business. In place of the tedious and unreliable dressing by hand labor, which can only give satisfactory results when an expert hand executes it with great care, machines can now be procured which will perform the same labor with reliable accuracy, and at the same time great dispatch.

Among the machines of this class, we hold that the one to which we referred on page 36 of our late February number, which is known as the Atchison stone cutting machine, and of which we now give a representation on this page, stands foremost. It is adapted for cutting and planing granite, or any other kind of stone, to dress and finish the surfaces more satisfactorily either for building purposes or polished work, and it does this work in considerably less than half the time that it can be accomplished by the most expert hand labor.



THE ATCHISON STONE CUTTING MACHINE.

The cutting tools are two in number, and are arranged in a strong head piece attached to a moving platen, similar to the iron planing machine. This platen, with the head piece, is made to move forward and backward over the stone, and the tools having a perpendicular, reciprocal, rotating motion, cut the surface at the rate of not less than 6,000 blows per minute. The rapidity of this motion is of great value in the use of the tools—the wear is less than one-half compared with hand work. The tools are semi-circular in shape at the edge, made of Jessop steel, and can be used constantly for at least forty-five minutes without changing, thus one set of tools will cut not less than 270,000 blows without re-sharpening.

The advantages of this machine are: 1st. That it is of simple construction, and therefore not liable to get out of order, 2d. It is very easily managed and requires but little care—so little indeed, that, 3d, one man can operate three machines and sharpen his own tools, which is easily done by the use of a die, a new and valuable method. 4th. They require little power to run them, one horse-power for each machine being amply sufficient. 5th. The tedious process of sighting or measuring is dispensed with, as the machine cannot possibly work the surface irregularly or out of wind. 6th. The edges of the stone are always evenly and perfectly cut without "chipping." 7th. The slight cutting blows of the tools, produced by a peculiar motion, leaves the surface absolutely solid and free from "stunning," which is important for polished work. 8th. The principle upon which it operates is eminently adapted for ornamental work. 9th. The rapidity and accuracy with which such machines cut moldings, cornices, ornaments, letters, etc., on all kinds of stone, place them far above all other attempts thus far made in this direction, overcoming the supposed insurmountable obstacles in the way of making ornamental stone-work by machinery. 10th. Last, but not least, the great saving of time and the diminished wear of tools.

We are informed that the machine here represented is the result of four years' steady work, to improve the plan of planing granite by machinery, and the inventor, Mr. Atchison, of Boston, can look back with satisfaction on the labor spent in this direction, as it has resulted in enabling contractors and builders to accomplish in hours what heretofore it has taken days to do.

New Method of Refining Petroleum.

The newspapers report that Major Henry Howell, of Sarnia, Canada, claims to have invented a new process of refining petroleum without the agency of heat. A sample manufactured from American petroleum of 45 gravity, is stated to be a very brilliant and white oil of 48 gravity and 122 fire-test. The yield from the crude was 93 per cent. But the most extraordinary claim for this process is not merely that the means used are entirely mechanical, but also that there is no production of gasolin or benzin, and the entire product is standard white illuminating oil, far superior to the oil refined under old methods. This process, if what is claimed for it be true, would be precisely what the producers have been looking for. It would be a saving of at least $120,000,000 per annum to the oil region, and would settle the little differences now existing between the producers and refiners—that is to say, if they secure the exclusive privilege of using this wonderful process. How the lighter parts of crude petroleum can, by a mere mechanical process, be retained so as to stand a fire test of 122°, is something truly wonderful, and is simply incredible, being equivalent to a mechanical decomposition of a chemical compound.

It is quite natural that those in the trade who are not fully acquainted with the nature of petroleum, and therefore capable of believing such statements at once, look with great anxiety for further particulars. On the other hand, those who know the nature of petroleum, simply disbelieve the whole report, regarding it as a pure fabrication of the newspapers, or a false pretense of the Canadian Major.

Important Engineering Scheme.—A plan is now being discussed by English engineers, by which not only the water of the Nile, but the silt—of which the greater portion is now wastefully deposited in the Mediterranean Sea—may be turned to good account as a fertilizer of the deserts of Nubia, Libya, and the Soudan. To this end is proposed the construction of a system of engineering works by which a portion of the Nile flood water, with its annual burden of soil robbed from the fertile slopes of the Abyssinian plateau, shall be diverted into these deserts, where it may deposit its rich sediment on the sands, and also irrigate and fertilize them. This, it is thought, can be accomplished by the erection of suitable dams and sluices at different points of the Nile, which structures would also greatly improve the navigation of the river.

Latest Market Report of Building Materials.

NEW YORK PRICES.

ARTICLES MARKED WITH A STAR (*) ARE QUOTED IN GOLD.

—o—

LUMBER.

Pine, very choice and extra dry, per M	$55 00 a 60 00
Pine, good	45 00 a 50 00
Pine, shipping box	18 00 a 22 00
Pine, common box	16 00 a 17 00
Pine, common box, ⅝	13 00 a 15 00
Pine, tally plank, 1¼, 10 inch, dressed, each	40 a 43
Pine, tally plank, 1¼, 2d quality	35 a 38
Pine, tally plank, 1¼, culls	25 a 28
Pine, tally boards, dressed, good	28 a 30
Pine, tally boards, dressed, common	22 a 25
Pine, tally boards, culls, dressed	21 a 23
Pine, strip boards, merchantable	16 a 18
Pine, strip boards, clear	22 a 25
Pine, strip plank, dressed, clear	33 a 35
Spruce boards, dressed	18 a 20
Spruce plank, 1¼-inch, dressed	22 a 25
Spruce plank, 2-inch,	28 a 34
Spruce wall strips	13 a — 15
Spruce timber, per M	16 00 a 19 00
Hemlock boards, each	14 a — 16
Hemlock joist, 2½x4	15 a — 16
Hemlock joist, 3x4	16 a — 18
Hemlock joist, 4x6	40 a — 44
Ash, good, per M	38 00 a 45 00
Oak	38 00 a 45 00
Maple culls	20 00 a 25 00
Maple good	42 00 a 45 00
Chestnut	42 00 a 48 00
Cypress, 1, 1¼, 2, and 2½-inch	35 00 a 40 00
Black walnut, good to choice	85 00 a100 00
Black walnut, ⅝-inch	75 00 a 85 00
Black walnut, selected and seasoned	110 00 a150 00
Black walnut counters, per ft	12½ a 20
Cherry, wide, per M	85 00 a100 00
Cherry, ordinary	60 00 a 80 00
White wood, chair plank	60 00 a 70 00
White wood, inch	40 00 a 50 00
White wood, ⅝-inch	30 00 a 35 00
White wood, ⅝ panels	35 00 a 40 00
Shingles, extra shaved pine, 18-inch	9 50 a 10 00
Shingles, extra shaved pine, 16-inch	8 50 a 9 50
Shingles, extra sawed pine, 18-inch	7 00 a 8 00
Shingles, clear sawed pine, 18-inch	6 50 a 7 50
Shingles, cypress, 24x7	20 00 a 22 00
Shingles, cypress, 20x6	12 00 a 15 00
Lath, Cargo rate	— — a 1 55
Yellow dressed pine flooring	25 00 a 35 00
Yellow pine girders	30 00 a 40 00
Locust posts, 8 feet, per inch	18 a 20
Locust posts, 10 feet	24 a 25
Locust posss, 12 feet	29 a 34
Chestnut posts, per ft	3 a 3½
Basswood per M	25 00 a 30 00

BRICKS.

Nominally.	Cargo.	Afloat.
Pale, per M.	2 50 a	2 75
Jersey	4 75 a	5 00
Up River	5 00 a	— —
Staten Island	5 25 a	— —
Haverstraw Bay	5 00 a	— —
" " choice	5 25 a	5 50
Favorite Brands	6 00 a	— —

FRONTS.

Croton—Brown, per M.	7 00 a 7 50
" Dark	8 00 a 8 50
" Red	9 00 a 9 50
Philadelphia	26 00 a 28 00
Trenton	24 00 a 29 00
Baltimore	34 00 a 38 00

Yard prices 50 cents per M higher, or with delivery added $2 per M for hard and $3 per M for front brick. For delivery add $5 on Philadelphia and Trenton, and $6 on Baltimore brick.

IRON—PER TON.

Duty.—Bar, 1 to 1½c. per lb.; Railroad, 70c. per 100 lbs.; Boiler and Plate, 1½c. per lb.; Sheet, Band, Hoop and Scroll, 1¼ to 1¾c. per lb.; Pig, $7 per ton; Polished Sheet, 3c. per lb.; Galvanized, 2½c. per lb.; Scrap Cast, $6 per ton; Scrap Wrought, $8 per ton—all less 10 per cent. No Bar Iron to pay a less duty than 35 per cent ad val.

Pig, Scotch—Coltness	21 50 a 22 50
Glengarnock	20 50 a 21 50
Eglinton	19 50 a 20 50
American, No. 1	16 50 a 18 00
American, No. 2	15 50 a 17 00
American, forge	14 50 a 16 00

Store prices. Cash.

Bar, Swedes, ordinary sizes	— 5 a — 6
Ba., Swedes, nail-rod	— — a — 6½

LEAD—PER 100 POUNDS.

*German	— — a — —
*English, common	— — a — —
*Spanish	— — a — —
*Foreign, refined	— — a — —
*Bar	5 00 a — —
*Sheet and Pipe	5 00 a 6 00
*Domestic	3 37 a — —

NAILS—PER KEG.

10d to 60d, common, fence and sheathing	2 30 a — —
8d and 9d, common	2 85 a — —
6d and 7d, common	3 10 a — —
4d and 5d, common	3 35 a — —
3d and 4d, light	4 10 a — —
3d, fine	4 85 a — —
2d, fine	4 85 a — —
Cut spikes, all sizes	2 85 a — —
Clinch nails, 1½ to 1¾ inch	5 00 a 5 25
do. 2 to 2¼ inch	4 75 a — —
do. 2½ to 2¾ inch	4 50 a — —
do. 3 inch and longer	4 25 a — —

TIN PLATES.—Duty, 1 1-10 cents per pound.

*I. C. charcoal, 10x14, per box	6 75 a 7 00
*I. C. coke, 10x14	5 50 a 6 25
*I. X. charcoal, 10x14	8 75 a 9 00
*I. C. charcoal, 14x20	6 75 a 7 00
*I. X. charcoal, 14x20	8 75 a 9 00
*I. C. coke, 14x20	5 50 a 6 25
*I. C. coke, terne, 14x20	5 25 a 5 50
*I. C. charcoal, terne, 14x20	5 75 a 6 25

ZINC.—Duty, sheet, per lb., 2½ cents.

Sheet, (cask) per lb	— — a — 6½
Sheet, (open)	— — a — 7

SOLDERS.

No. 1	— 9½ a — 10¼
No. 2	— 9 a — 9¼

STONE.—Cargo Rates.

Amherst Freestone, in rough, per cubic foot	— — a — 85
Berlin Freestone, in rough	— — a — 95
Berea Freestone, in rough	— — a — 75
Brown-Stone, Portland, Conn	1 25 a 1 50
Brown Stone, Belleville, N. J	1 00 a 1 50
Granite, rough	— 60 a 1 25
Canaan Marble	1 25 a 1 50
Dorchester, N.B., Stone, rough, per foot	— — a 1 03

PAINTS.

*Carmine, American, per lb. gold	5 00 a 5 50
Chalk, per lb.	— 00¼ a — 00⅜
China Clay, per ton gold	20 00 a 22 00
Chrome yellow, dry, per pound	— 12½ a — 28
Lead, red American, per pound	— 7 a — 8
Lead, white American, pure, in oil	— 7½ a — 8
Lead, white American, pure, dry	— 6¾ a — 7¼
Lead, white English, pure, in oil gold	— 10 a — 10½
Litharge	— 7 a — 8
*Ochre, Fr., dry, per 100 lbs	1 50 a — —
Ochre, ground, in oil, per lb	— 6 a — 15
Ochre, Vermont, per 100 lbs	— 75 a 1 00
*Orange Mineral, English gold	— 9½ a — 10
Paris White, American	— 1¾ a — 1½
Paris White, English, prime	— 1¾ a — 2
Paris Green	— 15 a — 28
Plumbago paint, patent, per lb	— — a — 25
Putty, per lb	— 1¾ a — 2½
Spanish Brown, dry, per lb	— 1½ a — 1¾
Spanish Brown, ground in oil, per lb	— 8 a — 9
Venetian red, per cwt	1 75 a 2 00
*Vermilion, Chinese, per lb	— 80 a — 90
*Vermilion, Trieste	— 70 a — 80
*Vermilion, quicksilver, bags gold	— 55 a — 57½
Vermilion, American, common	— 15 a — 18
Whiting, per 100 lbs	— 40 a — 75
Zinc, white American, dry, No. 1	— 6½ a — 7½
Zinc, white American, No. 1, in oil	— 8 a — 10
*Zinc, white French, dry, (Red Seal) gold	— 8 a — 8¼
Zinc, white French, in oil gold	— 10 a — 10½

VARNISHES—PER GALLON.

American Wearing Body	3 50 a 4 00
Coach Body	2 35 a 3 50
do do	1 80 a 2 00
Furniture	1 25 a 2 50
Black Asphaltum	1 00 a 1 50
Brown Japan	1 00 a 1 20
Liquid Paint Dryer	1 35 a 1 75
Harness, (black)	3 00 a 4 50
Shellac, Spirits	3 00 a 3 50

CEMENT—PER BARREL.

Portland (imported)	2 75 a 3 40
Portland (American)	2 50 a 2 90
Roman	2 80 a 3 25
Keene's, coarse	6 50 a 7 00
" fine	10 00 a 10 50
Martin's, coarse	6 00 a 6 50
" fine	10 00 a 10 50
Rosendale	1 00 a — —

DEADENING AND ROOFING MATERIAL.

Mineral Wool for Roofs and Deadening, per lb. — 1¼ a — 1½

HAIR.

Cattle, per bushel of 7 lbs	— 9 a — 12½
Goat, " "	— 15 a — —

SLATE.

Purple roofing slate, per square	$6 00 a 7 00
Green slate	6 00 a 7 00
Red slate	10 00 a 11 00
Black slate, Pennsylvania	5 00 a 5 25
Slate tiles, 1¼-inch, rubbed, per square foot	20 a — 25

PLASTER PARIS.

Duty.—20 per cent ad. val. on calcined; lump free.

Nova Scotia, white, per ton	2 80 a 3 00
Nova Scotia, blue	2 75 a 2 80
Calcined, Eastern and city, per bbl	1 00 a 1 10
Calcined, city casting	1 15 a 1 20
Calcined, city superfine	1 20 a 1 25

LIME—PER BARREL.

State, common	— 80 a — —
" finishing	— 90 a — —
Rockland, common	— 75 a — —
" finishing	— 90 a — —
Ground	— 80 a — —

Add 25 cents to above figures for yard rates.

FOREIGN WOODS.

MAHOGANY.

St. Domingo, crotches, ordinary to good, per ft	— 15 a — 20
St. Domingo, crotches, fine	— 20 a — 30
St. Domingo, logs, small	— 5 a — 8
St. Domingo, logs, large	— 8½ a — 14
Frontera, Mexican, large	— 9 a — 12½
Frontera, Mexican, small	— 6 a — 8
Other Mexican	— 6 a — 12½
Honduras	— 6 a — 12½

ROSEWOOD.

Rio Janeiro, ordinary to good, per lb	— 2 a — 3½
Rio Janeiro, good to fine	— 4 a — 8
Bahia, ordinary to good	— 1¾ a — 3
Bahia, good to fine	— 3 a — 7
Honduras, per ton	10 00 a 20 00
Satin Wood, per foot	— 15 a — 25
Tulipwood, per lb	— 6 a — 7
Lignumvitæ, small, per ton	10 00 a 20 00
Lignumvitæ, large	25 00 a 50 00

CEDAR.

Cuba, per superficial foot	— 8 a — 12½
Mexican, small	— 8 a — 9½
Mexican, large	— 10½ a — 12½
Florida	— 40 a — 75

DOORS, WINDOWS, AND BLINDS.

DOORS, RAISED PANELS, TWO SIDES.

2.0 x 6.0	1¼ inch.	$ 67	—
2.6 x 6.6	1¼	— 95	—
2.6 x 6.8	1¼	— 99	—
2.8 x 6.8	1¼	1 04	—

DOORS, MOLDED.

Size.	1¼ inches.	1½ inches.	1¾ inches.
2.0 x 6.0	$1 23	—	—
2.6 x 6.6	1 52	1 93	—
2.6 x 6.8	1 57	1 85	—
2.6 x 6.10	1 59	2 01	—
2.6 x 7.0	1 62	2 09	—
2.8 x 6.8	1 62	2 99	2 57
2.8 x 7.0	1 69	3 17	2 69
2.10 x 6.10	1 79	2 26	2 84
3.0 x 7.0	1 87	2 45	3 00

INSIDE BLINDS.

Per lineal foot, 4 folds, pine	50 a — —
Per lineal foot, 4 folds, ash or chestnut	— 80 a — —
Per lineal foot, 4 folds, cherry or butternut	— 95 a — —
Per lineal foot, 4 folds, black walnut	1 15 a — —

DRAIN AND SEWER PIPE.

(Delivered on board at New York.)

PIPE, per running foot.

2 inches diameter,	$0 13	10 inches diameter,			$0 70
3 "	0 16	12	"		0 80
4 "	0 20	15	"		1 25
5 "	0 25	18	"		1 60
6 "	0 30	20	"		2 00
7 "	0 35	22	"		2 50
8 "	0 45	24	"		3 00
9 "	0 55				

GENERAL REVIEW OF THE MARKETS.—Business has improved in some degree during the past month, but not to the extent that we had hoped at the writing of our last report. Buyers, while doing considerable figuring, having offered stout resistance to any increase in cost. Building operations are very active in the up-town portions of the city, while in the lower parts many large contracts are contemplated, under way or in process of completion. Plans have been filed for a large number of buildings to be erected during the Spring and Summer, and the prospects are that builders will have their hands full during the coming months. The effect of this activity must soon be felt in the markets, and the prospects are for a most excellent business year. No important immediate reaction on prices is expected, however, and there probably will be none. A portion of the trade talk of higher prices this Spring, but unless production is restricted to closer limits than is now anticipated we do not discover upon what basis an advance could be made.

THE MARKETS IN DETAIL.—In the lumber market, during the month, business has not changed much, and no particularly new features have been shown. The opening of river navigation will give larger supplies and a corresponding increase of business, as there is place for a fair amount of lumber. Buyers exhibit, however, the same caution they showed last season, and must be met upon a conservative basis to insure their custom. Local consumption promises to be good this spring, both for building and manufacturing purposes, but every item of cost will be figured closely, and notwithstanding the talk of some dealers about better prices and restricted production buyers will adhere to their present policy of purchasing only for immediate needs and at close figures.

In the brick market there has been more or less demand, but not of an active or decided character. Building operations are beginning to be lively with the opening of Spring, but builders are not inclined to push matters until the weather is more settled. The current consumption therefore has been to a large extent only a matter of necessity, with demand correspondingly restricted.

In the lime market about the same general features have prevailed. The amount of Eastern offering has been rather moderate, and it found sale as fast as received at former rates. State lime has remained steady in price.

In the lath market supplies have been comparatively small, and values have reacted to some extent. Early in the month sales were consummated at $1.60, but later at $1.55, at which price we close.

In the hardware market business has made some headway, and a very cheerful feeling has prevailed. Prices have been well sustained, and in some cases there has been a tendency to greater firmness.

In the paint market there has not been much animation in a wholesale way, and few features of general interest have developed.

In the metal markets Scotch pig-iron has been dull and trade unsettled. American pig has been rather quiet, most buyers receiving enough on contract to supply immediate wants.

Domestic pig lead has declined in cost, and considerable irregularity has been shown. Tin in pig has found a good demand with pretty liberal sales at times. Tin plates have found rather a slow sale, and have weakened a trifle in price. Sheet zinc has declined slightly.

Enormous Public Works in France.

While England is groaning under the effects of a commercial depression which promises to be of long continuance, France, though it has its share in the general stagnation of trade, is occupied with gigantic projects for public improvements. The republic, scarcely less than the empire, adopts the paternal theory of government, and is setting itself to work to add incalculably to the means of internal intercourse and the facilities for commerce while providing employment for its laborers.

This theory of government is by some considered to be a false one, but it can be easily shown what can be done under it in the direction of public improvements. So the drainage of Haarlem Lake was done, and that of the Zuyder Zee in Holland is now being done by the Dutch government, which guaranteed the investments made by the capitalists. The only question to make such governmental management successful is whether honest men can be found to direct it. Unfortunately, as the majority of our government employés are politicians, and these, as a class, cannot be quoted as examples of honesty and disinterestedness, it is better for us to keep the government entirely out of all such enterprises, which experience has proved can be done quicker, cheaper and better by private contract.

M. de Freycinet, the Minister of Public Works in France, has outlined a scheme of railway, canal, and harbor extension, for 1879, which will cost the enormous sum of $800,000,000, and will probably have legislative sanction for it in its entirety. The money for these unparalleled works he proposes to raise by an issue of three per cent. bonds, redeemable in seventy-five years; and that he can get the whole amount without trouble the experience of all recent French loans affords abundant proof. The new chance for investment is eagerly awaited by capitalists, large and small; for enormous sums are now lying idle in bankers' hands.

One of the main features of the plan, and that which will consume the greater part of the vast appropriation, is the extension of the railroad system of France. The rest of the money will mainly go to the construction of new harbors and the improvement of the old ones. Another great public work which is urgently demanded by several of the departments is a canal from Creil-sur-Oise to Beauvais, Amiens, and Albert, with two important branches. It is averred that this extensive canal would be of the greatest value to the north of France; and it would certainly be the most considerable of all navigable French waterways, and would have the effect of reducing by one-half the present freight charges from English ports to Amiens, Paris, and beyond.

A scheme for the construction of a network of metropolitan railways in Paris was hardly perfected before M. de Freycinet stepped in and claimed the perfected lines as belonging to the category of lines of general interest. Their concession has therefore been transferred from the Municipal Council to the general Government. The cost of their construction is estimated at nearly a million dollars a mile. The Minister of Public Works has also obtained the appointment of a supreme commission on the treatment and utilization of French rivers, composed in equal thirds of legislators, officials, and manufacturers or agriculturists. It will consider irrigation, motive power, inundation, water supply, sewage, and similar questions.

Add to all this his vast project of harbor improvement, and we see that M. de Freycinet has laid out a scheme of public works for France which will occupy the republic for many years to come, constituting a system of internal improvements of extraordinary magnitude, which, if it is successfully completed, will itself make the new republic memorable for generations.

One of the most interesting features of the plan is the construction of what are known as light or narrow-gauge railways, largely as feeders to the main lines, on the most extensive scale. A commission was appointed last January to examine into this class of railways, both at home and abroad, and report on its value and feasibility; and the result of their inquiries has determined M. de Freycinet to build the narrow-gauge railways throughout all France. The English engineering journals find fault with the conclusions of this commission, but they are very interesting.

They recommend a reduction of the gauge to 1 meter (3 feet 3⅜ inches), and in some instances even to 75 centimeters, ¾ of a meter (2 feet 6 inches), whereas in England a 3-foot gauge is preferred. They advise the dispensing with fences except at especially dangerous points and near dwellings; that the stations should consist merely of a waiting room, ticket office, and station master's lodgings; that the cars should be of two classes, with possibly an upper story; that they should be without useless ornamentation; and that the rolling stock should be at a minimum—in fact, that everything should be arranged with a view to strict economy. Under these conditions they estimate the cost of the roads, per mile, at an average of about $22,000. They put the average speed at from 9.3 to 12.4 miles an hour.

The subject of narrow-gauge railways is now one of the most interesting in the whole range of railway questions, and it is well worth careful thought and study. During the last few years they have been built more or less extensively here and abroad, and they are likely to come into still greater use, as being cheaper in construction and in working, especially in new countries.

Mutual Relations of Capital and Labor.

EXTRACT OF A LECTURE BY ABRAM S. HEWITT.

The ideas on the present serious struggle between capital and labor, brought forward recently by Mr. Abram S. Hewitt, are worthy of serious consideration, chiefly because he was chairman of a congressional committee on that subject, and as such had special opportunities to hear all sides of the question, even the most extreme views, socialistic as well as otherwise; more than any one else he is therefore competent to judge fairly about the latest phases which this all-important question has developed among us. We will give the most important points of the lecture in order to enable our readers to form more correct ideas than are most generally prevailing. He spoke as follows:

"The three cardinal and unchangeable facts of humanity are the individual, the family and society. There is and can be no other basis for government or religion. The fundamental characteristic of the individual is personal liberty; of the family, love, and of society, justice. Personal liberty implies equality of rights and contains the germ of individual property, while justice implies its equitable distribution; and this distribution can only rest upon the axiom, to each according to his work. The establishment of the right of men to govern themselves and to own and control the fruits of their labor may be said to have been only completed in our own day. With the recognition of these rights has come a vast increase in the amount of wealth, which it is the object of society to accumulate and distribute. This growth in wealth is the direct result of the physical, political and mental enfranchisement of man. The question of the distribution and ownership of property is surrounded with increased difficulties by reason of this increased wealth and of the comparatively recent enfranchisement of a large portion of the human race.

"Given, then, a state of things in which the wealth was in the hands of one class and the muscular power in the possession of another, it was inevitable, as it was just, that a struggle should arise to enforce a different ratio of distribution. What is known as the conflict between labor and capital has thus a natural origin, and so far from being a subject of regret it is to be welcomed as evidence of a healthy and growing vital force in the organization of society. The first step taken beyond the crude and spasmodic strikes was about fifteen years ago, when the principle of conciliation was successfully adopted at Nottingham. Arbitration was next introduced. But conciliation and arbitration are only transitional means for bringing about the ultimate relations of peace and harmony which must exist between capital and labor. All wealth is not capital. Outside of the portion of human wealth employed in the work of production and distribution there is a vast fund otherwise employed in ministering to the wants, the luxuries, the tastes, the charities of mankind. Labor really aims to transfer to itself a larger portion of the proceeds of business, or, in other words, to withdraw a portion of the outside fund not in use as capital and transfer it to labor. The struggle, then, is for the ownership, not of active capital, but of that portion of the wealth of society which is used for other than productive purposes. In its essence, therefore, the conflict is between riches and poverty, and is an attempt to change the existing ownership of wealth.

"We find society divided into the very rich, the great middle class, the industrious working class and paupers. If the first and fourth classes should cease to exist humanity would not have cause to shed many tears. The problem is to get rid of these two extreme classes without revolution and without injustice. How can this change of ownership be effected? Already the employers and employed meet upon the equal ground of open discussion. It is not a difficult step to reach the ground of joint ownership. There is one fact which points to an easy solution of the whole question, and that is the enormous growth of corporations for the conduct of industrial enterprises. The corporative principle is a necessity for the development of society and for placing its products upon a basis of equitable division. This division of ownership must, however, spring not from charity but from mutual interest. It may be objected that corporations are liable to abuses and develop evils, but the evils under which the world suffers are incidental to its progress and, in fact, compel progress. The progress that has been going on toward a more equitable distribution must result in the diminution of great fortunes, the improved condition of the poorer classes and the consequent extinction of pauperism. Thus, at length, the way is opened for the amelioration of humanity by growth instead of by revolution, and henceforth society will take no steps backward."

It may be a consolation to alarmists to find that a man of such clear insight in practical matters as Mr. Hewitt takes such a hopeful and even cheerful view of what the future has in store for the well-being of the human race in general.

New Nickel-Plating Solution not Patented.

Messrs. Boynton, Wiler & Co., in England, have for sale a new nickel-plating solution, which they confidently recommend for the following reasons: 1st. It is a solution of the double salt of cyanid of nickel and potassium, and consequently not a solution which is used and prepared by the alleged Adams process. 2d. It will plate on all metals directly, including zinc, lead, and solder, and penetrates deeply into the pores of the cathode, thereby preventing oxidation. 3d. It will positively plate three times faster than any known process; sometimes in about eight minutes. 4th. It never requires a special regulation by electricity, thereby preventing the burning of the smallest articles by the strongest currents. 5th. Articles to be plated never become injured from oxidation in the solution. 6th. It produces a coherent, tenacious, and flexible deposit, superior to any known to science. 7th. No acid dips are required for any kind of work, while Dr. Adams claims that acid dips are very essential for good results. 8th. The expense of keeping the solution in perfect working order does not exceed $5 per hundred gallons per month, if ordinary care is used, as in all other solutions.

They are prepared to sell this solution on favorable terms, thereby dispensing with the license or royalty business altogether.

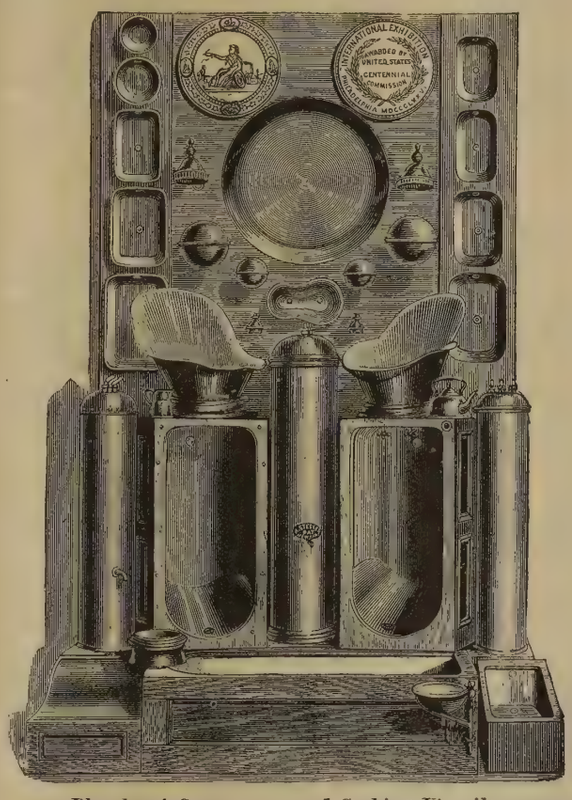
Home Department.

Plumbers' Copperware and Cooking Utensils.

Copper is justly considered as the material best adapted for many domestic and culinary purposes, such as bath tubs, boilers for ranges, water kettles, wash kettles, baking dishes and pans, coal scuttles, etc. But in case the article is intended for the preparation of anything destined for food, it needs the protective coating of pure tin, in which case it is much better than any other material, such as galvanized, or even glazed or enamelled iron; in appearance it is far superior.

It is not surprising that the manufacture of tinned copperware has for many years been a prominent industry. Among the houses in this business that of Mr. Henry Steeger has become well and favorably known to the trade throughout the Union. Mr. Steeger commenced business in New York over twenty-seven years ago, locating first on 18th street below Lexington avenue. The growth of his trade requiring more extended quarters, he purchased, some eighteen years ago, the premises now occupied at 143 and 145 East 31st street, which from time to time have been improved, so that it has become the largest and best equipped factory in the world. The building is a substantial brick structure, five stories high, and 62 by 180 feet. On the first floor is the tinning room, supplied with vats and other appurtenances for tinning and planishing sheet copper, in which processes he has made great improvements. In the rear is the machine-shop, with lathes, planers, and other iron-working machinery, all the tools used being made on the premises. Behind is the boiler department, where the copper boilers are made.

On the second floor is the spinning room, and in its rear another department where the copper is rolled and hammered, there being seven sets of rolls and seven hammers employed for this purpose. On the third floor front is the carpenter shop, where all the wood-work for bath tubs is constructed, and a planing mill and sawing department, with the best class of wood-working machinery. The fourth floor is used for lining bath tubs, and the fifth floor as a drying department, all lumber used being thoroughly seasoned, cut into lengths, dovetailed together, and placed in the drying department to prevent the warping of the same.



Plumbers' Copperware and Cooking Utensils.

All materials and finished articles are conveyed from one floor to another by means of an elevator, while the whole establishment is carefully arranged for the prosecution of the business, in the best and most expeditious manner.

Mr. Steeger is a gentleman some fifty-five years of age, has a thorough knowledge of copper working, and has done much to perfect the processes of manufacture of the several articles turned out at his factory. He is ably assisted in the management by his son, Henry Steeger, Jr., while the establishment gives employment to over sixty workmen.

Among the articles manufactured are copper boilers, showers, bath tubs, sinks, foot and seat tubs, and cooking utensils; copper bars and brass drainers of any size, shape, or description made to order. Among the improvements introduced by this establishment we must mention the patent head boiler, which is much stronger and a great deal more ornamental in appearance than the old-fashioned riveted head. Three of them are represented in our engraving, together with bath tubs and cooking utensils.

Mr. Steeger's goods received awards at the American Institute Fairs in 1870 and 1877, and also a medal and diploma of merit at the Centennial Exhibition. They are shipped to all parts of the United States and to Europe.

A New Poison for Rats and Mice.—At the Zoötechnical Institute, in connection with the Royal Agricultural Academy at Proskau, a series of experiments has been carried out upon the comparative activity or inactivity of the various poisons most commonly employed for the destruction of rats, mice, and other rodents. The result of these are now published by the director of the Institute, Dr. Crampe. Of all the materials expermented with, the most efficacious proved to be precipitated carbonate of baryta. This occurs as a heavy, fine, white powder, devoid of taste or smell, and can be purchased at any ordinary drug store. In the experiments of Proskau, a portion of it was mixed with four times its weight of sound barley meal, and made into a stiff paste with water, and small pellets of the soft cake introduced into the holes of rats, house-mice and field-mice. One great advantage of this preparation is that the smallest quantity of it proves fatal. Further, it appears to cause immediate and complete paralysis of the hind extremities, so that it may be assumed that mice eating of it in their holes will die within them, and so not prove destructive in their turn to domesticated animals that might otherwise devour the carcasses. It was found in practice that neither fowls nor pigeons would touch the paste, either in its soft state or when hardened by the sun, so that its employment is probably free from danger to the occupants of the poultry yard. Some rabbits on the other hand, that got access to the paste, ate heartly of it, and paid the penalty with their lives.

Remedies for Whooping Cough and Diphtheria.

The latest remedy highly recommended for whooping cough is carbolate of soda, evaporated from a small porcelain crucible over a spirit lamp, so that the vapor may permeate the sick room. This remedy is probably very excellent, as it is an antiseptic, while whooping cough is caused by a fungoid growth in the air channels, which, by aid of the microscope, have been proved to exist in the expectorations. Yschamer has even recently produced whooping cough in rabbits by inoculating them with the fungoid growth sometimes found on the skins of apples, which the microscope showed him to be similar to the fungus found in the whooping cough expectoration.

The latest remedy recommended for diphtheria is to gargle with water into which some flour of sulphur has been mixed; or to blow the dry sulphur through a quill or glass tube into the throat, or by inhaling the vapors of burning sulphur. These remedies are also based on the theory that diphtheria is a fungoid growth in the throat, but different from that producing whooping cough.

It is claimed that since the use of this remedy has more and more extended in England the mortality from diphtheria has decreased. In 1858 more than 20,000 died; in 1860, 5,000; in 1876, 3,000, while recently 50 patients at Princess Mary's Cottage Homes were all cured in this way.

Humor in the Family.

Good humor is rightly reckoned a most valuable aid to happy home-life. An equally good and useful faculty is a sense of humor, or the capacity to have a little fun along with the humdrum cares and work of life. We all know how it brightens up things generally to have a lively, witty companion, who sees the ridiculous points of things, and who can turn an annoyance into an occasion for laughter. It is a great deal better to laugh over some domestic mishaps than to cry or scold over them. Many homes and lives are dull because they are allowed to become too deeply impressed with a sense of the cares and responsibilities of life to recognize its bright, and especially its mirthful side. Into such a household, good but dull, the advent of a witty, humorous friend is like sunshine on a cloudy day. While it is always oppressive to hear persons constantly striving to say witty or funny things, it is comfortable to see what a brightener a little fun is—to make an effort to have some at home. It is well to turn off an impatient question sometimes, and to regard it from a humorous point of view instead of becoming irritated about it. "Wife, what is the reason I can never find a clean shirt?" exclaimed a good but rather impatient husband, after rumaging all through the wrong drawers. His wife looked at him steadily for a moment, half inclined to be provoked, then with a comical look, she said: "I never could guess conundrums; I give it up." Then he laughed, and they both laughed, and she went and got his shirt, and he felt ashamed of himself and kissed her, and then she felt happy; so, what might have been an occasion for hard words and unkind feelings, became just the contrary, all through the little vein of humor that cropped out to the surface. Some children have a peculiar faculty for giving a humorous turn to things when they are reproved. It does just as well oftentimes to laugh things off as to scold them off. Laughter is better than tears. Let us have a little more of it at home.

The Necessity of Plenty of Sleep.

A writer in the *Scribner* for February, considering "The Relations of Insanity to Modern Civilization," speaks of the loss of sleep as a prominent cause of insanity. He says:

"During every moment of consciousness the brain is in activity. The peculiar process of cerebration, whatever that may consist of, is taking place; thought after thought comes forth, nor can we help it. It is only when the peculiar connection or chain of connection of one brain cell with another is broken and consciousness fades away into the dreamless land of perfect sleep, that the brain is at rest. In this state it recuperates its exhausted energy and power, and stores them up for future need. The period of wakefulness is one of constant wear. Every thought is generated at the expense of brain cells, which can be fully replaced only by periods of properly regulated repose. If, therefore, these are not secured by sleep, if the brain, through over-stimulation, is not left to recuperate, its energy becomes exhausted; debility, disease and disintegration supervene. Hence the story is almost always the same; for weeks and months before the indications of active insanity appear, the patient has been anxious, worried and wakeful, not sleeping

more than four or five hours out of the twenty-four. The poor brain, unable to do its constant work, begins to waver, to show signs of weakness or aberration; hallucinations or delusions hover around like floating shadows in the air, until finally disease comes and

"Plants his siege
Against the mind, which he pricks and wounds
With many legions of strange fantasies,
Which in their throng and press to the last hold
Confound themselves."

The Dangers of Open Hatchways.

The frequent fires in the business parts of New York city give ample opportunity for observation, and we have more than once been profoundly impressed with the rapid spread of a fire to the upper stories along the staircases, and especially through the shafts of elevators or hatchways.

A regulation was introduced some time ago that hatchways should be closed on each story; the intention of this was that upward drafts and consequent rapid spread of fires to the upper stories should be prevented by trap doors on every floor; but this was misinterpreted, and the hatchways in many cases are merely surrounded by a partition with doors, which by no means prevent an upward draft, but in fact make of every hatchway a huge chimney, and may make matters worse should there be an opening in the top, where the hot, ascending air can escape. A strong suction would be the result and a consequent fanning of the flames below by the access of fresh air supplying the place of the hot air or smoke ascending by the elevator shaft.

We are pleased to learn that there is now a bill before the State Legislature making it compulsory to have all elevator shafts and hatchways provided with a trap door on every floor, which must all be closed at night, when, as experience proves, the great danger for the spread of fires prevails, as our down-town warehouses in New York are most always unoccupied during the night.

We hope this measure will become a law, in which case there would be only one thing to guard against, namely, forgetting or neglecting to close the hatchways at night. Everybody knows how careless employees often are, and, after having done their duty for some time, frequently begin to trust to luck, and finally think it unnecessary trouble to go up stairs every night to close the hatchways and open them again in the morning; they conclude to spare themselves this trouble and only close the nearest one below, but the danger is not done away with, as the precaution becomes inoperative.

Considering this danger, we were doubly gratified by the inspection of the mechanical device used by the Excelsior Hatch-Cover Co., of 120 Broadway, (Room 4), New York, by which all the trap-doors in a hatchway are successively closed and opened by turning a crank below, without requiring the operator to touch any of them. The crank turns a windlass, unwinding a rope, which passes through pulleys, one of which is attached to the back of each trap-door; when the rope is relaxed by unwinding it from the windlass, the trap-door on the upper floor closes first, then the next below, and so on, until they are all closed. By winding the rope upon the drum, the lower trap-door opens first, then the next above, and so on, thus satisfying the operator by sight that all the doors are closed at night, and are also successively opened in the morning, after which the shaft is ready for the use of the hoisting gear, whether that be an elevator or a simple hoist.

We ought also to mention one of the minor details, because it is of importance and an illustration of ingenuity. It is known that in shafts where elevators run there are two vertical beams, placed diagonally opposite each other, as guides to the car, which are also provided with teeth, to arrest the car and prevent its falling, by means of the well-known safety arrangement in case of any accident by the breaking of the suspension cables. These vertical beams take up space in the shaft, while a cover in which corners for these beams are cut out, cannot be made to work freely on its hinges; it must be made as much narrower in its whole length as will correspond with the thickness of the vertical beam next to which it is hinged, and when closed leaves an open slit of the same width. Now this should not be, as it will allow a draft to ascend; therefore the inventors have added a sliding piece, which at the moment that the trap-door is down, automatically closes this aperture, and thus makes a well-fitting door, in spite of the difficulty referred to.

The above is not written for the purpose of recommending this invention, as it it does not need it, being so fully and universally approved that they have been adopted by the score in various warehouses, and new ones are continually being erected all over this city, and elsewhere.

We wish to add that the above company have never sought nor asked legislative action, but have relied solely upon the merits of their invention to make its value appreciated.

Miscellaneous and Advertising.

Nickel-Plating.—Wenzel's patent perforated carbon box anode for holding grain nickel. A. C. Wenzel, 114 Center street, New York city.

An Abandoned Water Wheel Test.—We regret to learn that the whole project for testing water wheels at Holyoke for the city of Minneapolis, Minn., which was announced in our February number, has fallen through, the Mayor of Minneapolis having refused to sign, on economical grounds, the bill authorizing an expenditure for water wheels.

The George F. Blake Manufacturing Company, of this city, have just completed a duplex pumping-engine, with a daily capacity of 2,500,000 gallons, for the new water-works at Warren, Ohio. The same company are also building a couple of pumping-engines, of a combined capacity of 1,500,000 gallons daily, for the new water-works at Clarksville, Tenn.

One of the best roofing materials in the market is Warren's National Asphalt Roofing. It is a very durable material for flat roofs, and is cheaper than tin. The Warren Chemical & Manufacturing Co. of 88 Maiden Lane, New York, who have the exclusive sale of the above mentioned roofing, also make a specialty of Trinidad asphalt and asphaltic cement for concrete walk pavements, cellar bottoms, etc.

Portland Cement.—Masons and others interested in Portland cement are invited to send to the well known manufacturers, J. B. White & Bros., 10 Pine street, New York, for their memorandum book on cements. This firm is in constant receipt of fresh invoices of cement from their English works, and can always supply it fresh and genuine. Their cement is claimed to be the strongest and best sold in this country.

The severe tests to which "Austin's" expanding corrugated conductors have been subjected, prove them to be unsurpassed by any other conductor in the market. They are manufactured of galvanized iron and all sheet metals, and being corrugated, admit of expansion, thus obviating any danger of leakage or bursting. The sole manufacturers of these conductors are Austin, Obdyke & Co., of 1705 and 1725 Chestnut street, Philadelphia, Pa. We are informed that a decision in a test suit regarding this patent has been recently decided in their favor.

Messrs. Goodell & Waters, the well known wood working machinery manufacturers of Philadelphia, recently purchased from the late firm of E. C. Tainter & Co., all their assets of every description; including tools, machinery and patterns of all machines heretofore built by Power, Tainter & Co., and E. C. Tainter & Co., and they are the sole owners of all of the original patterns of these machines. They continue the business at 3,103 Chestnut street, and are sustaining the reputation of the late firm, for perfect and finished work.

Washable Kalsomine.—For curing damp walls and also as a washable kalsomine English Petrifying Liquid is highly recommended. It is made in various colors and the white can be stained to any shade. It fills up the pores of plaster, brick, etc., and prevents penetration of damp. The use of it in England is almost universal, and where there is so much damp and the quality of building materials is left to the decision of the builder, it should be extensively used in this country. It possesses the further advantage of being cheap. Howard Fleming, 10 Pine street, New York, is sole agent in the United States.

Elihu Burritt.

Death robbed us lately of one of our early contributors—Elihu Burritt, generally known as the Learned Blacksmith. Several of his articles are to be found in the first numbers of our journal, and therefore we may be allowed on this occasion to recall a few facts of his life, as they suggest many valuable lessons to young mechanics who are inclined to bewail the fact that the necessity of earning a living deprives them of the opportunities of culture which are enjoyed by other youths more fortunately circumstanced.

Burritt was born in 1810, in New Britain, Conn. His father was a shoemaker, who, having a family of ten children, could not afford to give them very liberal advantages. When 17 years old Elihu was apprenticed to a blacksmith, and it was during his labors at the anvil that a great deal of his study was accomplished. He was a natural mathematician, but also had a great taste for the languages, and with little assistance he mastered French, Latin, and Greek, and later acquired a knowledge of other tongues. It is related of him that when 22 years old, being ashamed to ask for aid, he resolved on working his own way in his studies, and he attained eminence in many fields of honorable usefulness. His literary reputation was world-wide, and he enjoyed in the largest degree the confidence and respect of good men. He is only one of the many self-taught scholars who have triumphed over difficulties which would have discouraged most men, and whose lives are useful as proving that wherever there is ambition, with a will behind it, there is always a way by which the object of that ambition can be attained.

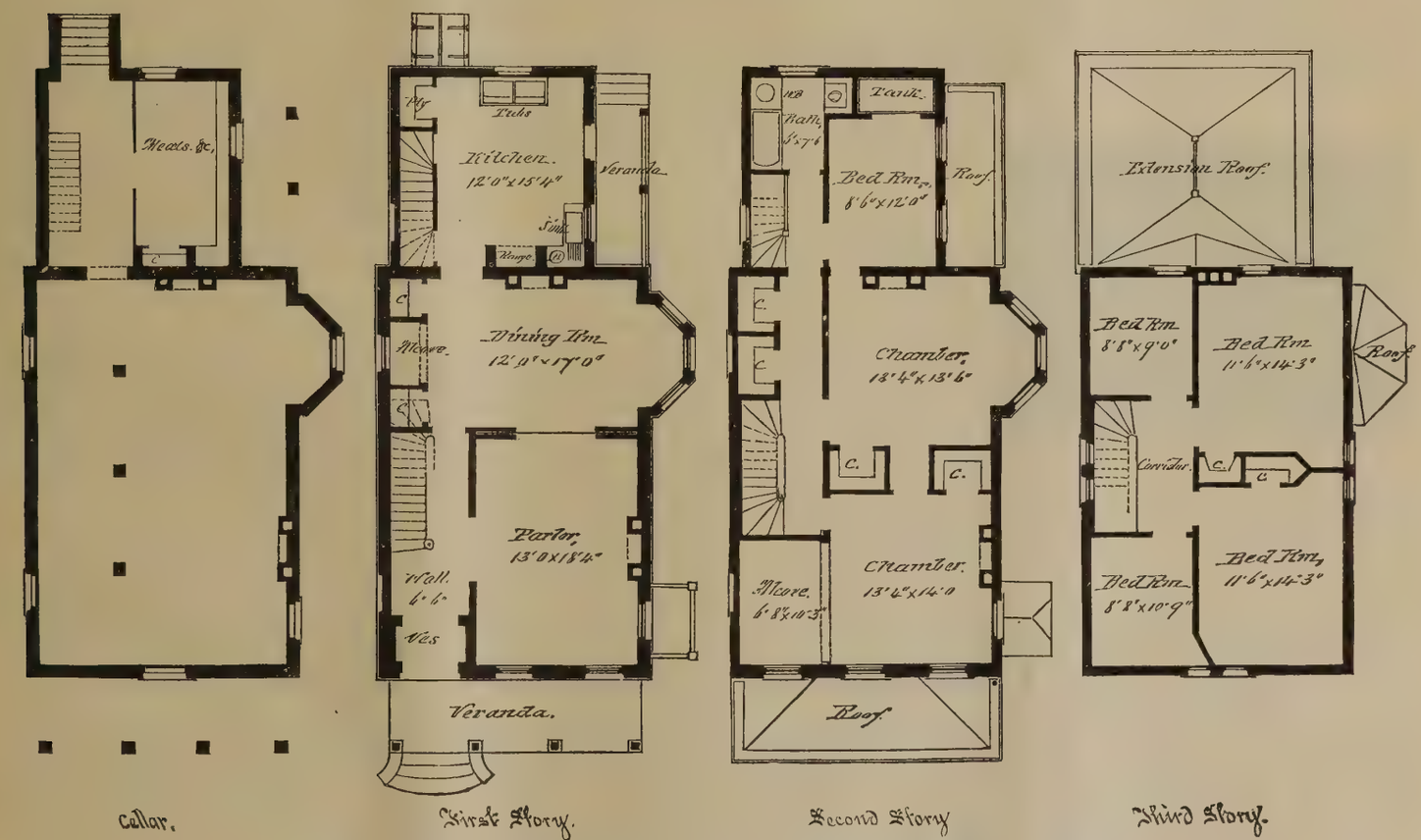
Safe Boiler Setting.

We acknowledge the receipt of several large lithographic designs of boiler settings as proposed and recommended by the Hartford Steam Boiler Inspection and Insurance Company. They give valuable hints to those engaged in this business, a mere careful inspection being sufficient to teach some valuable lessons. One important feature is that the boiler is nowhere embedded in brick, but is solely supported without touching the brick or mortar anywhere, so that it is accessible everywhere exteriorly and can always be thoroughly inspected and any incipient defect at once revealed. Experts know how brickwork has often covered up serious defects, which could not be discovered until it was too late, hence we earnestly recommend the study of these designs to all interested. Another practical advantage is that the brick-work is reduced to straight, square walls.

A Suburban Dwelling.

The accompanying plans represent a dwelling erected at Plainfield, N. J., after designs prepared by George W. La Baw & Son, architects, of Jersey City, N. J. The intention was to build a house which would occupy a small portion of the width of a plot of ground 50 feet front; thus enabling the owner to have a lawn and carriage road without the general appearance of crowding.

Reference to the plans will show at once the extreme simplicity of the design, which contains the comforts of a house in the city, and at the same time the grace and cheerfulness of a suburban dwelling. On the first floor are placed the dining room, parlor and



DESIGN FOR A SUBURBAN DWELLING, COSTING ABOUT $3,500.

kitchen, a roomy staircase hall, with vestibule, and doors opening on veranda. Leading from the kitchen to second story are stairs for the use of servants. In the second story are placed three large rooms or chambers (one with alcove), also the bath room. In the attic are small rooms for children and servants. All rooms are provided with necessary light and ventilation, thus insuring health and comfort to the occupants. The exterior walls from foundation to plate are built entirely of Jersey brick, with a heavy coat of Portland cement on the outside to protect them from the weather. The plaster is painted two heavy coats, in light, cheerful colors, to suit taste of owner.

The floor beams, roof timbers, etc., are of seasoned spruce, thoroughly bridged with spruce bridging; the roof timbers are covered with hemlock boards and felt. The felt is overlaid with best quality black slate of a uniform color, with tin flashing at all angles, and valleys, and in gutters. The studding for partitions are of 3x4 inch hemlock, provided with plate and sill where running at right angles with floor beams. The exterior walls are furred off on the inside to prevent dampness from penetrating the house.

The floors throughout are of narrow, tongued and grooved pine boards, blind nailed.

All walls, partitions and ceilings throughout are plastered two heavy coats (scratch and brown), finished with a heavy coat of hard finish; all rooms and halls on first and second stories, except kitchen, are finished with neat plaster cornices and centers, in keeping with rooms.

The trim throughout is good, the kitchen and bath room are wainscoted. The stair rail, newel and balusters, are of clear black walnut, finished with oil.

The dining room and parlor on first floor, and two large rooms on second floor are furnished with marble mantels, with grate and summer piece to each mantel.

The main rooms on first and second floors are furnished with heat from a portable furnace set in cellar. The furnace is supplied with cold air through a duct from outside the building.

The bath room is furnished with tub, bowl and closet, each supplied with water through lead pipes leading from kitchen, and tank placed in second story of extension. The kitchen is furnished with wash trays, sink and boiler; the plumbing throughout is done in a thorough manner, with the best of material.

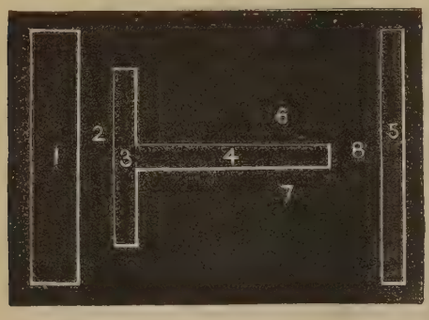
The wood work throughout the interior is painted three heavy coats of paint, the bath room and kitchen grained to imitate oak and walnut.

The cost, complete, is about $3,500.

Great Engineering Marvels—Long Branch vs. Coney Island.

The success of the improvements on Coney Island, in drawing New Yorkers there during the hot days, has stimulated those interested in property at Long Branch to do something, not so much in the way of attractions as for the ease of access, the attractions having already been there for a long time. The work now in progress consists of nothing less than the construction of an artificial safe harbor on the dangerous shore of New Jersey, and is undertaken chiefly by the Lelands, who did much for Saratoga, and have now undertaken to do as much if not more for Long Branch. The competition of Coney Island is acknowledged; in a short time, as if by magic, palatial hotels sprang up on the barren sands, attracting visitors in numbers as large as 70,000 a day, and it is expected that if Long Branch is made as easy of access it will attract its old patronage.

The Lelands, backed by $100,000 of New York money, have projected a pier in front of the Ocean Hotel, to be built on hollow iron piles, or rather columns, from 30 to 50 feet long and from 6 to 13 inches in diameter, which are now being driven in, and for that purpose are pointed at the lower end, but the point has an opening, through which water is ejected by means of a steam force pump, which displaces the sand under it and eases the sinking of the pipes through the sand very much, until they reach the hard-pan, which lies at a depth of some 15 to 20 feet below the bottom. 133 of these columns will support a pier 660 feet long and 50 feet wide; a net-work of iron girders will se-



cure the tops of the columns, over which a plank flooring 15 feet above high water will be laid, with a light-house at the end of the pier, while a horse car railroad will run over it. In front will be a breakwater 30 feet wide and 225 feet long.

In order to give the reader an idea of the relative position, the adjoined figure gives it in outline; 4 is the pier described and 5 the breakwater, which is constructed by the aid of wooden piles 12 inches in diameter and from 70 to 80 feet long, dovetailed with T iron and fringed with great iron rings, making the whole breakwater like an enormous sieve, breaking the force of the waves but not the flow of the water, which, at the end of the pier, will be 45 feet deep, while along the pier, 250 feet from the shore, it will be 18 feet deep. In our outline 6 indicates where vessels can lay with safety during a southeast wind, 7 where they will be safe during a northeast wind, while 8 is a safe place when the wind is due east; 3 is the bulkhead, 2 the road along the bluff, and 1 is the location of Leland's hotel.

In connection with this pier a regular ferry, at rates of 60 or 80 cents, will run from New York every half hour during the day and every hour during the whole night. Only trustworthy steamers will be used for this purpose, combining speed and safety, while unsafe boats will not be allowed to land at the pier. Besides this reduction of transportation, which heretofore was $2, the charge for bathing-suits will be 25 cents, while the price for meals will also be reduced, so that hot nights can be passed at the Branch at an expense of not more than $1.25 or $1.50, leaving New York at 6 P.M., arriving in 1¼ hours after a delightful sail, and returning at any time.

Property at Long Branch, which has gone down considerably of late, is again going up, and expectations are high, especially in regard to the reception and dispatch of freight at the pier, which will create a new current of trade. In the meantime a request has been made by the Long Branch Pier Co. to the New York Dock Commissioners for the privilege of using Pier No. 4, North River, during the coming summer for the accommodation of a line of steamboats to be run between this city and the Branch.

Those interested in the improvements on Coney Island, hearing of all this, are not idle on their side, but seem determined to keep up the competition with Long Branch to the bitter end, (but sweet to the public, as they will enjoy the multifarious benefits of this competition). It is reported that at a recent meeting of the Dock Commissioners, Mr. George Lorillard said that he represented a company which proposes to build a steel pier at Brighton Beach, Coney Island, and asked for the privilege of using Pier No. 1, North River, during the coming summer for the accommodation of a line of steamboats to be run between this city and Brighton Beach. A pier 600 feet long and 150 feet wide, resting on steel piles, was to be built, and boats would be run every fifteen minutes. The proposed pier is to be erected west of Brighton Beach. The company is soon to be organized, and Mr. Lorillard will probably be the president of the Board of Directors. The capital stock is to be $200,000, all of which is said to have been taken.

This Coney Island pier, in any case, will be safer, being less exposed to the ocean gales than the pier at Long Branch, which old Jersey fishermen eye askance, and, with hands in their pockets, predict that the first great storm will upheave the whole concern and break down the market for old iron.

Night Blindness and Collisions at Sea.

A correspondent of the New York *Sun* gives the following interesting account of "night blindness in Russia, and adds some suggestions regarding this defect in vision occurring at sea:

"This apparently strange phenomenon is very common among the Russian peasantry, and is known by them as 'night blindness.' It is attributed to the want of fatty secretion, resulting from the long Lenten fast to which the peasantry of the Greek Church adhere in spite of the remonstrances of their priests. With Ash Wednesday in Russia the peasants give up eating eggs, lard, fat of any kind, and the use of milk. The consequences are that, in the majority of cases, toward the end of the fasting period the peasantry are 'night blind.' They cannot discern any object or form after sunset, and even a light brought close to the eyes is only dimly seen, and conveys no idea of size or shape to them. With daylight this defect disappears, and the blind men of the night may be the most keen-sighted in the daytime. With Easter and its accompanying feasts the peasantry entirely recover from this malady—only to suffer from it again the following year when they recommence their fast.

"Perhaps at this season of the year, when the public are startled by appalling collisions at sea, accompanied with great loss of life, it may be opportune to draw attention to this little known form of blindness. Investigating committees in cases of shipwreck often find that the evidence of the survivors differs in regard to the lights seen. Some declare that the lights were clear and distinct, others that none were discernable. While color blindness is acknowledged, and care taken on railways and steamships that the employees shall be free from this defect, as precaution is taken against night blindness. Soldiers and sailors entering the government service are examined and their eyesight tested, but in the mercantile marine no such precaution is taken. One man with defective eyesight, stationed as 'lookout,' may hurry hundreds to premature death."

Paris is to have a system of under-ground railways, like those of London.

New Publications.

A Pocket-Book for Chemists, Chemical Manufacturers, Metallurgists, Dyers, Distillers, Brewers, Sugar Refiners, Photographers, etc. By Thomas Bayley, Assoc. R. C. Sc. I. E. & F. N. Spon: London and New York.

Engineers and architects have long been provided with an abundance of *vade mecums* containing all the necessary formulas and tables which come into daily use in their professions, but hitherto such aids to memory, embodied in a convenient and portable form, have been wanting to chemists. To supply this deficiency is the object of the handy little book whose title heads this notice. Within the compass of a volume so small that it may be readily carried in one's breast-pocket, we find grouped together nearly all the data that the chemist and chemical manufacturer may need in the daily practice of their professions.

The table of contents embraces the following subjects, each of which is treated quite as fully as necessary for all practical purposes: Atomic weights; chemical calculations and rules for indicet analysis; weights and measures; thermometers and barometers; chemical physics; boiling points, etc.; solubility of substances, specific gravity, etc.; analysis of gases, water, volumetric, qualitative, and manipulative; mineralogy; assaying; alcohol, beer, sugar; miscellaneous technological matters, relating to potash, soda, sulphuric acid, chlorin, photography, milk, petroleum, etc.

The author is to be congratulated on his success in producing a work whose excellence and practical value must create for it a large demand from those for whom it was prepared, as well as from laboratory students; and the publishers, who are so well known for their issue of other valuable scientific books, must be equally praised for the handsome style in which they have put forth the one under consideration.

Apple Blossoms. Verses of Two Children. By Elaine and Dora Read Goodale. New York: G. P. Putnam's Sons.

It is indeed a rare thing in literature when child-life is expressed by the children themselves, especially when it is done not only in rhyme, but when a true poetical vein pervades the whole, and when the verses are the almost unconscious outflow of early youth, as fresh and spontaneous as the youthful authors themselves. The little volume is properly dedicated to their mother, and as a specimen of the natural flow and easy grace of the poems, we copy a couplet from the dedication:

"The love that gave us life and strength;
That guarded day by day;
What tenderest words can half express?
What answering love repay?"

The various poems show by their titles alone that these interesting young poets are true children of nature. The titles are: "Falling Snow," "Spring Song," "Song to Summer," "Autumn," "Dead Leaves," "Lily and Rose-Bud," "Our Chickens," "An April Rain," "Sunset," etc. We wish the book in many hands. It deserves the patronage of all who take an interest in education, as a specimen of the results where children's natural love of nature is encouraged instead of being crushed out, as in most of our city schools.

The New England Business Directory for 1879. Sampson, Davenport & Co., 155 Franklin street, Boston. Price $6.

The publishers of this very valuable directory are also the publishers of the Boston Directory, the Boston Almanac and Business Directory, the Massachusetts Register, the New York State Business Directory, etc. The directory before us consists, in fact, of eight directories bound together, seven for the New England States, and one for Boston city. It contains some 1,400 pages, and 200 more devoted to advertisements. It gives the addresses of more than 200,000 business and professional men, admirably arranged in such a way that any of them can easily be found; besides these addresses, it contains a great deal of information, statistical as well as otherwise. Thus we find, for instance, that the population of Boston is now about 350,000, and increasing at the rate of 16¾ per cent every five years. We recommend this excellent work to all who have business interests in New England.

The Magazine of American History. New York: A. S. Barnes & Co.

Of this most excellent serial we have recently received the January number—the initial number of the third volume, and which well sustains the high charactor of those that have preceded it. Its table of contents embraces valuable and interesting articles on "The Birth of the Empire State," illustrated; "The Globe of Vlpius," illustrated; "Oregon, the Origin and Meaning of the Name"; "Original Documents"; "The Treatment of Peace, 1783"; "Correspondence between William Jay and John Quincy Adams"; "A Diplomatic Round-Robin"; Reprints, Notes and Queries, and Literary Notices. This periodical is issued in very sumptuous style by the publishers, and no one who is interested in the history of his country can afford to be without it.

Turbine Wheels. By Prof. W. P. Trowbridge, of Columbia College. New York: D. Van Nostrand.

This little publication—No. 44 of Van Nostrand's Science Series—is intended to show the inapplicability of the theoretical investigations of the turbine wheel as given by Rankine, Weisbach, Bresse, and others, to the modern constructions introduced by Boyden and Francis, demonstrating as it does the

grave error in all former treatises on hydraulic motors, while it clearly explains how the best practical results have been obtained by those modern engineers who have entirely discarded the formulas of the old standard works. It was formerly published in "Van Nostrand's Magazine," and is a reprint in more lasting form, and as such we recommend it to the serious attention of all interested in the subject, especially to teachers of theoretical hydraulic science, to many of whom it will serve as an eye-opener.

Correspondence.

SHINGLE MACHINE.

The manufacturer of the shingle machine of which we gave an account on page 6 of our late January number, (which account we copied from a contemporary), is requested to come forward with his address, the price, etc., of his machine, as we have received several inquiries about it, of which the following is a specimen:

To the Editor of the Manufacturer and Builder:

I noticed in your late January number an account of a new machine for splitting shingles. From the account it would appear as though this machine was a perfect success; as yet they never have been, owing to the manner in which they are split; still, if they can be made perfectly smooth, without slivers or cracks, it would be just the machine needed. I have a shingle mill, and run a Huntington machine, upright circular saw, 40 inches in diameter; it will cut shingles 15 and 16 inches wide, and, when filed smoothly, makes a splendid shingle.

My reason for writing is to ascertain what the machine referred to will do, the number per day of 12 hours run, the power required to drive it with good results, the price, etc. I would not want to have anything to do with it unless it will make a first-class article, and not waste the timber. Redwood is the lumber we use here altogether. Please send me full particulars, and also a drawing of the same. E. P.

Notes and Queries.

This department is intended to furnish, for the benefit of all our readers, information on any subject of scientific or practical knowledge falling within the field of The Manufacturer and Builder. *All persons possessing additional or more correct information than that which we give relating to the questions, are cordially invited to communicate it to us for publication. We also request that all questions or answers be written on separate pieces of paper, and addressed to the Editor.*

QUESTIONS.

(2324) Phonograph and Phonophone.—The following item is clipped from the *Evening Telegram* of February 26th, wherein it is stated that there was a "phonograph invented twenty years ago by Scott": "*The Throat.*—'Keep your mouths shut,' was the advice of Dr. Elsberg, lecturing before the Academy of Sciences at Union Hall. Men should listen to the Indian proverb, and open first their eyes, then their ears, and last their mouths. If the mouth is duly to perform its delicate functions during the day, it must be closed during the night. The bellows, wind-chest, and reed-pipes that form the human voice must have their periods of rest, for sound is a mode of motion. Wherever we produce sound we have vibration. The old phonograph, invented twenty years ago by Scott of London, and perfected by Koenig of Paris, was made on the principle of indentations of a needle on smoked paper. Edison substitutes tinfoil. His machines should be named 'Palingenophones, or regenerators of sound. One of them, being set upon the platform, was then charged with the melody of 'My Grandfather's Clock,' and it ticked with such precision and deplored the deceased with such distinctness of articulation, that the audience was highly amused." Will you please explain the manner of operation, and oblige.—F. E. F., New York City.

(2325) Population of New York City.—What is the population of New York city, including its suburbs, according to the latest census?—S. T., Greenville, Conn.

(2326) Prevention of Scale in Boilers.—I have heard of a lining for steam boilers that will prevent scale being formed. Can you give any information about it?—J. J., Bethel, Me.

(2327) Soldering Iron with Brass.—Please explain the manner of soldering iron with brass.—D. T., Chardon, O.

(2328) Depreciation of Coal by Storage.—Have any reliable experiments ever been made to determine the amount of depreciation coal undergoes by age?—C. P., Chester, Mass.

(2329) To Prevent Explosions when Casting Lead.—You are aware of the inconvenient and sometimes dangerous explosions by which many mechanics have had their patience sorely tried when pouring lead around a damp or wet joint, to have it explode, blow out, or scatter, from the effects of steam generated by the heat of the lead. How can this be prevented?—M. K., Dedham, Mass.

(2330) Cleaning the Scalp.—What is the best substance for cleaning the scalp and the hair? Soap, borax, soda, ammonia, alcohol, bay rum, etc., are recommended; which do you think best?—W. B., Earlville, Pa.

(2331) Varnishing Foundry Patterns.—I have not been very successful in preparing shellac varnish for foundry patterns. Can you give me some information about it?—R. F., Dunbarton, N. H.

(2332) Bronzing Iron.—What is the best way to bronze iron? and where is it being practiced?—H. T., Elmira, N. Y.

(2333) The Spygmophone.—Please explain how the spygmophone is constructed. It is a new instrument intended to transmit the sounds of the pulse and the heart by telegraph. By answering this you will oblige one of your old Medical Students, now an M. D., New York City.

(2334) Coating Metal Plates with Platinum.—I see from your answer to Query 2309, page 71 of your March number, that there is some difficulty in electro-plating with platinum without heat. I do not care about the heat, but wish to know of a method to cover iron with platinum. If you have heard of a method to do this with or without heat, you will much oblige A Constant Reader, Hollidaysburgh, Pa.

(2335) The Largest Cotton Mill.—Which is the largest cotton mill in the United States?—C. G., Tipton, Ind.

(2336) Starch Luster.—Will you please give me a recipe for starch luster.—S. S. C., Worcester, Mass.

(2337) Quantitative Relation of Flour and Bread.—How much bread ought I to make from a barrel of flour? and is there any difference in different kinds of flour?—J. T., Bridgeport, Conn.

(2338) Fiber of Malva.—I send you a sample of the stem of the malva plant, which grows here in great abundance, and it appears to me that the fiber is well adapted for spinning, or at least for paper-making. What is your opinion about taking out a patent for this application?—L. S., San Jose, Cal.

(2339) Chemical Tests.—What are the principal tests required for the study of chemistry? You would confer a favor on many of your young readers by giving a list of them and their uses.—D. T., New York City.

(2340) Journals Published in Paris.—The French have a republic now, but can they continue it? Are they as much of a reading people as we are? They have their journals, to be sure, but does their number at all compare with ours? Are there any statistics accessible on this point? If so, please give them.—D. R., Charleston, S. C.

(2341) Chilling Cast-Iron.—How can I chill cast-iron to great hardness?—G. S., Amherst, Mass.

(2342) Analyzing Substances.—How can I in the easist way analyze a given substance, so as to ascertain what it is chemically composed of?—W. C., Belleville, Ill.

(2343) Leyden Jar.—I made a Leyden jar in the usual way, as directed in the books, and tried to charge it with an electro-magnetic machine, but could not collect any electricity? Can you tell what might possibly be the matter?—F. C. S., Richmond, Va.

(2344) Alum Baking Powder.—Please inform me what substances, and in what proportion, are used to make alum baking powder. I do not understand it as described in the *Scientific American* of February 15th. Please give the wholesale cost of the ingredients, and the method of mixing them.—C. E. W., Worcester, Mass.

(2345) Is Petroleum a Preservative of Leather?—I read the following in a paper, and ask your opinion as to its correctness: "If pegged boots are occasionally dressed with petroleum between the soles and the leather, they will not be likely to rip. If the soles and uppers are dressed with petroleum, they will resist wet and wear well. The pegs are not affected by dryness after being well saturated with the oil."—A Petroleum Distiller, Greenpoint, N. Y.

(2346) Assaying Gold.—What is the analysis of pure gold?—H. D. E., Oakland, Cal.

(2347) Black Stain for Leather.—Will you please give a recipe for staining leather a jet black, leaving the leather soft, like glove calf. There are preparations used here by some shoe manufacturers to stain the red side of calf cuttings, which are very useful in making up a cheap and durable grade of goods. A difficulty to overcome is the oil in the leather. The strength of a solution to prepare the cuttings for the black contains too much sal soda, and to use less does not produce the desired black.—L. H. W., Buffalo, N. Y.

(2348) Ornamental Iron Manufacturer.—Can you give the address of a manufacturer of plain and ornamental iron objects, such as brackets, bedsteads, etc.?—H. C. S., Easton, Mass.

(2349) Annealing Iron.—What is the best and cheapest way to anneal chilled cast-iron, or common iron?—H. C. S., Easton, Mass.

(2350) Books on Molding, Boiler-Making, and Gearing.—Will you be kind enough to give a list of books that treat on molding, boiler-making, and cog wheel gearing.—H. C. S., Easton, Mass.

(2351) Making Extracts.—Is there any book on making extracts—extracting the perfume from plants, etc.?—W. H. R., New Philadelphia, O.

(2352) Our Iron Production.—Can you give any statistical statement of our iron production last year? If so, please do.—M. F., Silverton, N. J.

REPLIES.

(1512) Wood and Straw Piano.—Since giving our answers to questions in regard to these instruments (see page 23 of our January number for 1878), they have become quite common, and are now for sale in most all music and toy stores, while the prices have been reduced to $1 for plain instruments of two octaves, and upward for larger and more finished ones. They were called Lignophones, meaning "wood sounders"; but such a combination is objectionable, being half Latin and half Greek, therefore Xylophone has been finally adopted for its name.

(2324) Phonograph and Phonophone.—In answer to the above we will say that the phonograph invented by Scott 20 years ago, was an entirely different thing from Edison's invention. It is a grave misstatement to say that Edison only substituted tinfoil for a needle, as there are other important differences, while the results of the machines are altogether incomparable, the Scott machine merely making wave lines, while Edison's phonograph actually speaks. Therefore we perfectly agree with the suggestion that if the name Phonograph is correct for the Scott machine, it is not correct for Edison's invention, as it is a real regenerator of sound. But we think the name Palingenophone too long, and propose simply Phonophone, the repetition in the name corresponding with the repeating nature of the instrument. In regard to the explanation of the instruments, we will only remark that in Scott's phonograph a needle was attached to a vibrating tuning fork or membrane, that its point touched a strip of smoked paper, and that this paper, driven by clock-work, on moving forward, the motion of the needle made wave lines of various shapes, according to the nature of the sound, especially varying with difference of pitch, high tones producing small waves and low notes larger ones. This was all that there was of Scott's phonograph. In Edison's phonophone a metallic membrane carries a point in its center, which, during the vibration of the same makes indentations in the moving tinfoil. When afterward this same tinfoil, with the indentations thus made, is caused to move in contact with the same point that made them, it will put the same and the membrane into the identical vibrations that produced the indentations; and we then hear the surprising phenomenon of the vibrating membrane producing the same air vibrations, and consequently the same sounds that caused the indentations, whether those sounds were words, laughter, crying, the crowing of a rooster, the barking of a dog, whistling, musical tones, or even the ticking of a clock.

(2325) Population of New York City.—According to the latest census we may set down for the population of

New York	1,050,000
Brooklyn	500,000
Newark	120,000
Jersey City	90,000
Hoboken	40,000
	1,800,000

If we add to this the estimate of 200,000 for the population of all the other small villages in the immediate vicinity of New York, such as those on Staten Island, the cities of Yonkers, Elizabeth, etc., all connected by ferries and railroads for the daily accommodation of the many business men of New York who reside in those places, we may estimate the actual population of New York and its immediate surroundings at 2,000,000 or even more, exclusive of the floating population, partially in the numerous hotels and on board ships in the harbors.

(2326) Prevention of Scale in Boilers.—Mr. Frantz Beuttgenbach gives the following recipe for the preparation of a coating for the inside surface of boilers to prevent the formation of scale: Gradually dissolve 5 pounds of a mixture of 25 parts of colophonium, 2½ of graphite, and 2½ of lampblack into 40 pounds of boiling gas-tar, adding about 1 pound of tallow. The solution is diluted with about 50 per cent of petroleum, and applied in a warm state. It has a pungent smell and should be put on rapidly, the precaution of using closed lanterns, or "safety lamps," being necessary. Its effect is to cause the scale to come off in large flakes when picked. An excellent disincrustant is sold by Messrs. John D. Moore & Co., of 261 Broadway, New York, the merits of which were fully stated in an article in our June number for 1878.

(2327) Soldering Iron with Brass.—Melt the plates of brass between the pieces that are to be joined. When the work is very fine the parts to be brazed should be covered with powdered borax, and melted with water, so that it may mix with the brass powder which is to be added to it. Expose the piece to a clear fire in such a manner that it shall not touch the coals, and let it remain till the brass begins to run.

(2328) Depreciation of Coal by Storage.—A case having come before the Bohemian courts, it was found that bituminous coal stored 12 months depreciated as follows: English Peases West coal suffered no depreciation; Ibbenbueren, Westphalian, coal lost 1.4 per cent in weight, 6 per cent in calorific value, and made 4.6 per cent less coke; Dortmund coal lost 2.6 per cent in calorific value, and made 2.1 less coke; Gelsen Kirchen coal lost 0.4 per cent in weight, 0.6 per cent of calorific value, and 2.1 per cent loss of yield of coke; Borgloh coal respectively, 2.6 and 1.5 per cent. Experts have testified that a loss of 2 per cent in transportation by cars was not extraordinary for bituminous coals.

(2329) To Prevent Explosions when Casting Lead.—The whole trouble may be stopped by putting a piece of rosin, about the size of a hickory nut, into the ladle and allowing it to melt before pouring.

(2330) Cleaning the Scalp.—Soap, especially when sharp, borax, soda, nor ammonia should be used on the hair; they injure its gloss and softness, causing it to become harsh and dry. Alcohol has the same effect, and so has bay rum when used frequently. We find it recommended in a

book that the best way to cleanse the hair and keep the scalp healthy, is to beat up a fresh egg and rub it well into the hair, or, if more convenient, rub it into the hair without beating. Rub the egg in until a lather is formed; wet the hands in warm water, softened with borax; by the time the lather is formed the scalp is clean; then rinse the egg all out in a basin of warm water containing a tablespoonful of powdered borax, after which rinse in clear warm water.

(2331) Varnishing Foundry Patterns.—The best varnish for this purpose is made by placing in a vessel 50 pounds of shellac, 10 pounds of Manila copal, and 10 pounds of Zanguebar copal, and heating it by the external application of steam for 4 or 6 hours, stirring it constantly in the meantime. Then add 150 parts of the finest potato spirits, and heat the whole for 4 hours to 190° Fah. This liquid is then dyed by the addition of orange color, and can be used for painting the patterns. When used for painting and glazing machinery, the varnish may consist of 35 pounds of shellac, 5 pounds of cocoriel copal, 10 pounds of Zanguebar copal, and 150 pounds of spirits. Similar varnish to the above is used quite extensively by pattern-makers, and much of the superior appearance of American castings is due to its use. It is therefore evident that the good quality of a varnish of this kind is of great importance, hence such a varnish for foundry patterns and machinery has been patented in Germany. It dries as soon as put on, and gives the patterns a smooth surface, thus insuring an easy slip out of the mold, and prevents the patterns from warping, shrinking or swelling, as it is perfectly impervious to moisture. The above recipe gives a varnish which very nearly fills the requisites desired, and we should not wonder if the German patent varnish mentioned were about the same thing.

(2332) Bronzing Iron.—We think that the best way of bronzing iron is that in use by the Philadelphia Smelting Company. This company has taken out patents covering the process for putting on iron a durable electro-bronze finish, which is claimed to possess the beauty and finish of real bronze at a very much lower cost, and to be wholly unaffected in color by the action of the atmosphere. The following is the process adopted: The articles to be bronzed are first put into a bath of paraffin, which stops further oxidation; they are then coated with a metallic alloy of copper and tin, and then subjected to the electro-bronzing bath, after which they are treated with a protecting varnish, and are then ready for use. The peculiarities in the texture are entirely due to the method of treatment. The alloy is said to possess superior malleability, approaching gold alloys in this respect, while its tenacity and solidity are very great. Specimens 8 inches long admit of being doubled up without apparent injury to the structure. It flows readily, is easily handled by ordinary workmen, and is capable of reworking from old scrap. It is also receptive of a high, smooth finish, wears well, and is largely used for machine journals, car bearings, and other purposes of a similar nature where a durable anti-friction metal is required.

(2333) The Spygmophone.—The spygmophone is even simpler than the spygmograph, which makes a wave line representing the nature of the beats of an artery, and is more valuable in some respects, being a graphic representation and a lasting record which can be studied. The spygmophone, now claimed as the invention of Dr. Stein, is nothing new, as we ourselves, some ten years ago, witnessed the transmission of the beating of the pulses of various patients in the Boston hospital, to a lecture-room in Salem, Mass., before a committee of the American Association for the Advancement of Science. Dr. Stein's apparatus appears to us, from the descriptions which thus far have reached us, to be nothing but an arrangement to cause the pulse to lift a little platinum plate furnished with a point, which makes contacts of the current, in the same rhythm as the pulse, and so they are transmitted. It appears to us that with the modern invention of the telephone, the carbon button, microphone, etc., something more refined can be produced, which will not only transmit the rhythm but also the peculiar noises heard when there is either organic or symtomatic disease of the heart.

(2334) Coating Metal Plates with Platinum.—We suppose that the method of Dode, recently invented in France, will suit your purpose exactly. He first coats the iron with a preparation of lead and copper; it is then ready for the platinum composition, which is made thus: 10 parts of platinum are converted into chlorid, mixed with 5 parts of ether, and permitted to evaporate in the open air. The residue is incorporated with a compound of 20 parts of borate of lead, 11 of red lead, some oil of lavender, and 50 parts of amylic alcohol. Into this mixture the article to be coated is dipped, then allowed to dry in the air, and finally heated to a moderate temperature in a muffle furnace. A practical demonstration of the *modus operandi* was recently given at the laboratory connected with the mint and Bank of England, at which the ease and simplicity of the operation were fully seen and acknowledged; but as the invention is a recent one, the important elements of time and wear to test the work are as yet wanting. The invention relates more particularly to the coating of articles of cast-iron, but is also applicable to the covering of other metals in order to preserve them from oxidation under the action of air, fire, or acid gases. The same process is applicable to glass. The processes hitherto known for the coating of metals have only imperfectly attained the object in view, inasmuch as the covering of copper, nickel, silver, or tin, applied by immersion or with the aid of galvanism, are not adapted to prevent oxidation. Dode's invention consists in the application of platinum in such a state of division as to enable it to be employed as a preservative against the oxidation of metals, whereby a considerable saving is effected, as compared with the systems at present in use, and much greater efficiency is obtained.

(2335) The Largest Cotton Mill.—The largest cotton mills in the United States are the Harmony Mills at Cohoes, N. Y., which run 575,000 spindles.

(2336) Starch Luster.—It consists simply of stearin, colored, or not, with a slight addition of ultramarine blue; a piece the size of a 25-cent coin is enough for ½ pound of starch. Boiling it for two or three minutes will add very much to the beauty and gloss of the linen when properly ironed.

(2337) Quantitative Relation of Flour and Bread.—It is said that Minnesota flour will make from 270 to 280 pounds of bread to the barrel, while that of Michigan will not make more than 240 pounds. It is a fact that wheat consisting mostly of starch will not make nearly so much bread as that containing a large proportion of gluten. Michigan wheat is almost entirely composed of starch, and that accounts for the smaller amount of bread to the barrel of flour. The Fultz wheat now being introduced in that section has little gluten in it. It is largely grown in the Cumberland valley, Pennsylvania. The Clawson wheat is also being introduced there, and is very popular with farmers on account of its prolific yield, but, like the Fultz, it is deficient in gluten, and will therefore make but a small yield of bread, and is universally condemned by good bakers, not only on that account, but because it will not make a large sized loaf in proportion to its weight. A choice grade of flour cannot be made either of Fultz or Clawson wheat; this is the universal testimony of all who have used them. Farmers are therefore advised not to sow these varieties.

(2338) Fiber of Malva.—There is such an abundance of fibrous plants that it is scarcely worth while to try to increase the staple; this is the first objection. The second is that new methods and machinery are required to treat a new kind of fiber, as each requires a special treatment, (compare, for example, flax with cotton). The third objection is the great prejudice of manufacturers, who can only with great difficulty be induced to try new fibers, for proof of which we refer to jute, against which a very strong opposition was manifested, and has scarcely died out yet. There has already been found a competitor to jute in India, near Bombay, namely, the Malachia Capetate, which is much whiter than jute, has a silvery luster like linen, is easily purified from adhesive matter, and grows in any soil that is too poor for jute to grow in.

(2339) Chemical Tests.—The list of substances used for the purpose of "chemical tests" are not exactly the same as those used for the experiments required in "the study of chemistry." We intend to give a list of the former in a future number, which will show you the difference of the two branches. The substances required for experimenting you will find mentioned in any text-book of elementary chemistry. The chemical tests are enumerated in the text-books or guides to analytical chemistry.

(2340) Journals Published in Paris.—From recent statistics it appears that there are no fewer than 1,190 daily, weekly, and monthly journals published in the French capital. Of these, 71 are devoted to religion, 104 to jurisprudence and administration, 153 to commerce and finance, 23 to geography and history, 139 to recreation, 31 to instruction, 90 to literature and philology, 18 to fine arts, 4 to photography, 8 to architecture, 15 to music, 17 to the stage, 70 to fashions, 134 to industry, 80 to medicine, 48 to science, 29 to the army and navy, 38 to agriculture, and 23 to sports. The number of daily papers published in Paris is 49, and political reviews, 17. These are only the papers in the city of Paris, which occupies, in regard to journalism and progress, the same position to France that New York city does to the United States; but other large cities in France as well as our own large cities, (like Philadelphia, Boston, Baltimore, St. Louis, Chicago, and Cincinnati), have local papers, thus we find large numbers in Havre, Toulon, Marsailles, Lyons, and other cities, of which however the statistics are not accessible to us. You will see by this enumeration that the French are by no means backward in regard to journalism.

(2341) Chilling Cast-Iron.—In a way similar to that in which ordinary iron is coated with a hardened surface. One of the best prescriptions is the following: Water, 10 gallons; salt, 1 peck; sulphuric acid, ½ pint; saltpeter, ½ pound; prussiate of potash, ¼ pound; cyanid of potash, ½ pound. Heat the iron to a cherry-red and dip as usual; if wanted harder, repeat the process. Some blacksmiths hold that it is better to leave the water and sulphuric acid out, grind the other substances to a powder, put this over the red-hot iron, when it will melt as a coating, and then dip in ordinary water. As far as our own experience goes, we think the latter method produces the hardest surface.

(2342) Analyzing Substances.—The only way to learn to do this is first to study elementary chemistry, so as to become acquainted with the chemical properties of the various elements and many of their compounds, and then to study analytical chemistry, which consists in the application of the knowledge thus obtained for recognizing what substance we have to deal with. You will see from this that it is not so easy a matter, and that it is impossible to convey in a few lines such an extensive knowledge of details as is required for that purpose—in fact, to become a good analytical chemist requires more study than to learn to write and speak several foreign languages, say French and German, with Latin thrown in.

(2343) Leyden Jar.—The trouble is simply that most electro-magnetic machines produce positive and negative currents in rapid succession, which give a series of shocks, but which neutralize one another when you try to collect them. Some of the larger kinds of these machines are provided with a commutator, which throws the currents in one direction; but even these cannot give much of a charge for a Leyden jar, as it is electricity of great quantity and little intensity, while a Leyden jar needs intensity alone, such as is produced by a friction electrical machine. You may charge such a jar weakly by an electric syringe, by a rubber strip, by a glass rod, in fact by anything that will produce electricity by friction. You can also charge it very strongly by an electric kite, if you send it up during a dry, cool day, or in summer during a thunder-storm.

(2344) Alum Baking Powder.—As the use of alum baking powders is injurious to health, we decline to give any instructions as to how to make them, especially as our correspondent wants to ascertain the wholesale price, etc., as if he were going to make their manufacture a regular business. Our opinion is that their manufacture and use should be forbidded by law, and the manufacturers severely punished.

(2345) Is Petroleum a Preservative of Leather?—If you are really a petroleum distiller, you need scarcely ask this question, as you must know from experience that petroleum is injurious to boots, by causing the leather to shrink too much. Our advice has always been to use castor oil for boots, and for softening old leather objects in general; it is far better than petroleum, which is by no means as good as ordinary oil. Next to castor oil cod-liver oil is the best, but its disagreeable odor makes it very objectionable for boots and shoes.

(2346) Assaying Gold.—You probably mean the test for gold. Pure gold is considered as an elementary substance, because thus far we have not been able to analyze it into any constituent parts. Only after we have discovered what it consists of, so that we can make gold from its constituent elements, will we be able to analyze it. But for this there is no hope just now, notwithstanding the sensational reports published from time to time. The test for pure gold is, first, that it is very soft and flexible, almost as lead; and second, that it is not attacked by boiling nitric acid. In order to prove this a small quantity is first melted with one-fourth of its weight of silver, rolled out very thin, and boiled in pure nitric acid. If it loses no more than this silver, it contains no baser metals, but may contain platinum, or some other similar metal; but this is not likely, as then it would not be soft and flexible, but hard, as most all alloys are. The rest is told on page 87 of this number, in an article entitled "The Precious Metals." We only wish to add that the process of cupellation mentioned there only removes the baser metals, but not the silver, and that to test it for this the method of quartation described is necessary.

(2347) Black Stain for Leather.—We would suggest that you use in the stain liquid ammonia instead of soda. This may cause the stain to penetrate in spite of the oil in the leather, while afterward, being volatile, it will evaporate and leave no injurious remnant, as is the case with soda. To produce a deep black, we would advise you to try a weak solution of bichromate of potash; this, with the tannin in the leather, produces a deeper black than the iron solutions usually employed. If it does not, you may afterward moisten the leather with logwood extract, which, with the bichromate of potash, gives a deep black. Use very little of the latter substance, as a small quantity goes a great way, and an excess may injure the leather.

(2348) Ornamental Iron Manufacturer.—The J. L. Mott Iron Works, whose advertisement appears on page 2 of our advertising department, are among the largest manufacturers of ornamental iron goods, and we advise you to address them.

(2349) Annealing Iron.—We do not know of any better and cheaper way than to heat the articles in boxes containing powdered hematite, or any other suitable oxid of iron, and let them cool slowly. The oxygen in the powder used, will at the red heat extract the carbon from the iron, which is the cause of its hardness. If the cause of the hardness of the iron is not carbon, but its inferior quality, caused by injurious impurities, such as sulphur or phosphorus, which makes iron hard and brittle, or, as blacksmiths call it, "short," there is no way of annealing it. Do not try to doctor a bad article; it does not pay.

(2350) Books on Molding, Boiler-Making, and Gearing.—Larkin's "Practical Brass and Iron Founder's Guide" gives all the necessary information on molding; price $2.25. Warn's "Sheet Metal Worker's Instructor" gives instructions to boiler-makers; price $3. While in Fairbairn's "Principles of Machinery of Transmission," illustrated with 150 wood-cuts, price $2.50, you will find all about toothed wheels of various kinds, their form, their epicycloidal and hypocycloidal curve, involute teeth, proportion of teeth, etc. We can furnish these books by mail on receipt of price.

(2351) Making Extracts.—The art of making extracts is taught in most all books on pharmacy; but in order to satisfy you and some other readers, we will publish in our next number an article on extracts.

(2352) Our Iron Production.—The production of iron in the United States during the year 1878, was 2,380,000 tons, (70,000 tons more than in 1877). It should also be added that 642,350 tons were on hand at the end of 1877, while at the close of 1878 this was reduced to 516,000.

THE MANUFACTURER AND BUILDER.

Vol. XI.—No. 5. MAY, 1879. ELEVENTH YEAR.

The Duplex Steam Pump.

The requisites of an economical steam pump are: 1st. It must be direct acting, so as not to lose any power by intermediate transmitters of the steam power to the water to be lifted.

2d. It must have a uniform piston motion, and therefore a uniform piston speed, so as not to lose the advantage resulting from the uniform momentum of the water when once in motion. Fly wheels are therefore a disadvantage, as they cause a very unequal piston motion—most rapid when half way, and gradually diminishing in speed toward both ends of the stroke, which is very bad when pumping an incompressible and heavy substance like water.

3d. As this makes the motion of the slide valves with an eccentric impossible, this motion must be secured by other means, in a positive and well regulated manner.

4th. The steam must be used in such a way as to attain economy, technically called, "it must achieve a high duty."

5th. There must be no dead point, but it must be possible to stop and start the pump at any part of its stroke, so that when inaccessible at the bottom of a mine or a well it can be stopped and started from above by simply turning the steam off or on.

6th. The pump must be compact, durable, everything accessible for repairs, and cheap for the work it is to accomplish.

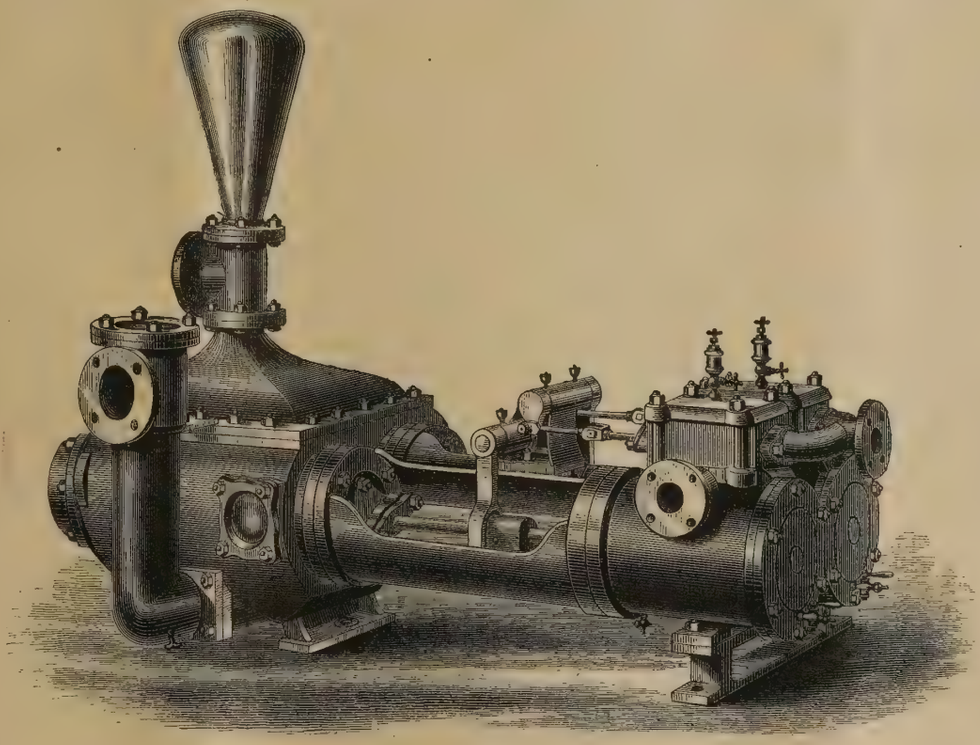
These are severe conditions, and so much more creditable to those who accomplish their fulfillment; they are even contradictory in some respects, and it is with pleasure that we state our belief that the problem has been satisfactorily solved in the Worthington duplex pumping engine, represented in our engraving.

It will be seen that there is a double set of pistons; but the peculiarity by which the problem of securing a positive slide valve motion is obtained, is that each piston works, not its own valve, but the valve of its neighbor; it does this by a rock-shaft and appropriate connections, and pauses at the end of its stroke until its own steam valve is opened by the motion of the other's piston rod, when it makes the return stroke.

It is evident that the combined reciprocal and uniform motion of two double acting plungers, driven at an unvarying speed, must force the water in a quiet, steady stream, while the silent seating of each water valve by its own gravity through the equalization of the water pressure at both sides, during the pause of the piston at the end of its stroke, makes it a noiseless pumping machine.

One of the beauties of this pump combination is that mentioned in the 5th condition, as it does not require an expert engineer to start and stop it; by simply turning on the steam it will do its work as long as there is steam furnished, and is always ready for duty.

Various sizes and kinds are made for raising large quantities of water to small hights, or for raising it to greater hights; for working against low and against high pressure, hence these pumps are adapted for general application, such as railroad stations, breweries, where water is raised to moderate hights, or for city water works, hydraulic elevators, etc., where great hight and pressure are to be overcome by heavy pumping in pipe lines. The noiselessness is also a great recommendation for its use in hotels and other public and private dwellings.



DUPLEX STEAM PUMP.

The Worthington Hydraulic Works where these pumps are made, were established in 1845, and have since that time earned a reputation which is steadily increasing. Their main office is at 239 Broadway, New York, while they have a branch office at 83 Water street, Boston. The factory is located in Brooklyn, N. Y.

The Farmers and Inflation.

During the so-called flush times, when the country was flooded with greenbacks, the value of the legal dollar fell as low as 40 cents in gold; this however was only for a short time, in 1864, and it soon regained a value of 60, 70 and 80 cents, until finally, after remaining awhile at 90 cents and above, it reached par.

The value of the various products of labor, and property in general, did not rise in equal proportion; thus, for instance, if we compare the prices of 1860 with those of 1873, (when the legal greenback dollar was worth about 70 cents), we find that corn and wheat had risen in price 50 per cent, while beef, butter and pork had risen about 100 per cent, and in general the price of the staples of food was doubled; on the contrary, the prices of farmers' implements, such as plows, spades, wagons, etc., were about the same, and also drygoods, while there was only a slight advance in groceries. So that on the whole everything that farmers wanted to buy cost about the same, while for their products they obtained more money. The farmers, therefore, could only prosper; but if we compare prices at the present time, when the legal dollar is at par and worth 100 cents in gold, matters are still more to their advantage; while the prices of farmers' products have partially fallen to those of 1860, in some instances equal, and in others still 10 or 20 per cent higher, the prices of everything a farmer wants to buy, such as tools, drygoods and groceries, are all considerably below the prices of 1860—in some instances 50 per cent lower.

It follows from this that the purchasing power of farm products is now nearly double what it was before the war, and considerably greater than it was during the flush times of 1873. The cause of this is the development and perfection of the manufacturing industries of the country—especially in the West; a development traceable mainly to the patent system, since the manufactures of the West are almost exclusively based upon recently patented inventions.

It is curious to see how short-sighted demagogues in Congress and elsewhere had the stupidity to declare that the patent system should be emasculated (and the progress of manufacturing interests arrested) for the benefit of the farmers, who, as is pretended by them, are oppressed and devoured by patent monopolies!

Well, inflation is over, and fortunately prosperity is beginning to reign, which after all is based on the success of the farmers. If they suffer all trade suffers, and if they should fail to produce, famine would reign supreme over all the land.

This reminds us of a picture on a farmer's wagon which impressed us in our childhood. It represented a priest, a soldier, a lawyer, and a farmer with a chicken and eggs under it was written the following Dutch rhyme:

> "En of gy bid, en of gy vecht, en of gy pleit,
> Ik heb de kip die the eyeren leit."

Which, translated, reads:

> "No matter whether you pray, or fight, or plead,
> I have the chicken that lays the egg."

The Manufacturer and Builder.

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This journal has the largest circulation of any mechanical monthly published in the United States. Its value as an advertising medium is therefore apparent.

Vol. XI. No. 5. ELEVENTH YEAR.

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Abatement of the Elevated Railroad Noises.

The old proverb, that "necessity is the mother of invention," has again been verified in the recent improvements made and now being introduced in the locomotives of the Metropolitan Elevated Railroad, with the purpose of abating the noise, against which there has been so much complaint.

It appears that most all the inventors who have exercised their genius in this direction, have confined themselves to attempts to deaden the rumbling noise made by the wheels, while in fact this was only one of the nuisances, and not the worst. The fitful, irregular puffing and snorting of the exhaust steam, especially strong when the train is starting from a station, and the loud hissing noise which accompanies every application of the brakes, as well as the noise made by the escaping steam when the safety valve is suddenly opened, are nuisances which, by those living near the stations, are declared to be far more disagreeable. After a close investigation and experiments for several months, it has been ascertained that there exists an English patent which appears to overcome some of these annoyances.

The Metropolitan Elevated Railroad has recently purchased the right of using this patent. The hissing noise is caused by the sudden escape of steam from the brake ejector when the engineer applies the brakes to stop the train. Hitherto the difficulty has been to apply a deadener to the top of the escape pipe which would effectually stop the noise, and at the same time permit the steam to escape freely. The improvement consists of a cylindrical chamber, with wire gratings at each end, the cylinder being filled with small glass beads about an eighth of an inch in diameter, and a hole in the center. Little wooden blocks had been tried as deadeners in the place of these beads, and it was found that the constant action of the steam made the wood pulpy and destroyed its efficiency. The beads, however, being very hard, are not affected by the steam, and being very small the steam, in passing around and through them, is subdivided into such small parts as to utterly break its power for producing noise, which it must produce when it comes out with a rush under a pressure of 120 pounds to the square inch. The top of the cylinder is above the roof of the cab, so that the steam, after passing through the beads, filters out into the atmosphere. According to a careful count, the number of beads required for each cylinder is about seventy-five thousand. It is feared that the company has got up a perfect "corner" in beads, as the number already purchased is about eight hundred thousand. Several millions more will be required to apply the improvement to all the engines.

The noise of the safety valves only occurs when the steam attains such a high pressure that it is necessary to allow it to escape to prevent the boiler from exploding. The valves automatically give an exit to the surplus steam, and this is also conducted through a pipe to this glass bead deadener, and must filter through the tiny spaces left by the glass beads and the holes in their center; in this way the noise is almost completely overcome.

In regard to the puffing of the exhaust steam, Mr. Baird, the Chief Engineer of the road, and Mr. Allen Stirling, have patented an improvement in the chimney of the locomotive which completely does away with puffing and snorting. It consists in an expansion chamber and an annular nozzle placed in the chimney, the effect of which is to produce a regular noiseless exhaust instead of an intermittent and sonorous one. The steam from the cylinders, instead of passing directly through the nozzles, is discharged into a chamber which is about ten times the capacity of the cylinder. This allows the steam to expand in volume, and vastly reduces its pressure; after expanding, the steam passes through the annular nozzle, which produces a much better draught than those hitherto used on locomotives. This nozzle encircles the smoke pipe in a way similar to that of an ordinary ejector; instead of having great volumes of steam escaping suddenly and intermittently, and with much noise, there is a continuous issue; the noise is so reduced that the puffing, if it may be called so any longer, cannot be heard a distance of over ten feet.

In addition to the great reduction of the noise, this improvement materially increases the working power of the engine, relieving the pistons from all back pressure. Engineers all agree that this is quite a novel feature in locomotive engineering. The steam being exhausted from the cylinders through a 5-inch pipe into so large a receiving chamber the immediate effect is to do away with much of the back pressure against the piston, thus allowing the engine to work with better power and produce more revolutions of the wheel with precisely the same pressure of steam. It is expected that it will enable the company to increase their speed at least 20 per cent. The engineer of engine No. 13, which is fitted with this improvement, declares that he can made the run (allowing the same time for stops) in 18 minutes instead of 20, which is the present running time from Rector street to Central Park.

An additional advantage is, as might be expected, a saving in fuel amounting to about 25 per cent. The coal remains in the same position in which it has been placed by the fireman, and is not jerked from the back to the front of the furnace by the violent pulsations of these blasts of steam; in most of the old engines, although the firemen place the coal at the back of the furnace, yet when the engine reaches the other terminus the coal is at the front, choking up the flues and interfering materially with the regular combustion of the coal. The fireman is then compelled to pull it back again, and this process has to be repeated at every terminus, causing a waste of fuel as well as frequent loss of time. In the improved engines this difficulty is entirely overcome, as the mild and uniform current of steam causes a steady, gentle draught, and so permits the coal to remain without disturbance where it was placed, so that it burns away like coal in a stove, makes no clinkers, and the fires need be cleaned only once in 24 hours instead of four or five times a day.

One of the most important incidental advantages is that this arrangement does away with the ejection of sparks. The effect of the violent blasts of steam in ordinary locomotives is to stir up the fires, draw the smallest particles of coal through the flues, and eject, in the shape of infinitesimal sparks, through the chimney. In the improved engines the exhaust steam passes out in such a gentle and uniform stream that the fire is never stirred and the smallest particles remain on it without being drawn into the flues.

The improvements above mentioned are now being applied to the engines in succession, and the difference is evident to any one; those known as Nos. 4, 5, 6, 7, 8 and 37 have become noiseless, and form a strong contrast with the others, which puff and snort as usual.

In regard to deadening the noise, the loudest being half way between stations, and made by the rolling of the wheels and vibration of the structure when the trains have attained a certain velocity, there is a patented invention of a Mrs. Walton, consisting of a soft, elastic support under the rails; but it turns out that there are now eleven claimants to the priority of this invention, and under these circumstances the companies' action in accepting it has been delayed until it is settled who is entitled to the priority. This appears to constitute a case where the patent laws retard the introduction of an invention. It may be said that the companies might as well introduce it and afterward pay the one who proves his title; but it must be remembered that the companies would then be at the mercy of that one, and nobody will accept anything before knowing what will have to be paid for it.

The Woodruff Scientific Expedition.

One of the scientific expeditions around the world, of which we gave a short account some time ago, is almost ready to start from New York. It is the Woodruff expedition, provided with a first-class steamer, the "General Werden," built five years ago on the banks of the Clyde to a German order. She is not a lightning steamship, her speed being from eleven to twelve knots, but that has its compensations to the passenger who has to live on board for over a year.

According to a special act of Congress, she has taken out an American register, which otherwise is not permitted for foreign built vessels. The alterations which are being made consist in the following: The first-class saloon will be the living room, the state rooms opening into it on either side; it extends from abaft the engines to the stern, and will be very comfortable. The smaller second cabin forward is to be the class room, where the lectures by the professors of the faculty of the expedition, under President W. S. Clark, will be given, and where the educational feature of the enterprise will take shape. It is intended to have the lectures succeed each other throughout the day, those who go out as students attending the courses according to the president's direction, and those who go more as tourists taking these draughts of knowledge at their will. President Clark promises to divide these classes in such a manner as to see that no young man committed to his care loses anything of what he should gain, while he will quickly be enabled to differentiate the remainder into classes who desire instruction in particular branches, or who simply desire no instruction at all. Down stairs, where the steerage formerly was, is to be used as a dining room, while further aft additional state rooms have been erected for those who prefer roominess to elevated positions in their sleeping apartments. Altogether on the two decks there are accommodations for 250 passengers.

Captain A. P. Cooke, of the navy, the commander, is a model navigator; he has already selected some of

his officers from the navy, and looks only to fitness. There is a crew of thirty seamen; thirty waiters and attendants, with the faculty of ten professors, and all the other officers of the expedition, raise the number of people officially connected close on a hundred.

The start is to be made as early as possible, because that will bring them to the various places to be visited at the best possible time. The Azores, Queenstown, St. Petersburg, London, and Havre will be visited before the fall, when they will proceed to the Mediterranean, and, after several stoppages, pass through the Suez canal to India, China and Japan, returning to San Francisco. This, and much more, explained by the directing spirits, was lately poured into the willing ears of a goodly company, including a deputation of twenty solid citizens from Boston, where, and in the Bay State generally, the expedition has warm friends, and whence many intending passengers have booked. There are still vacant places on the passenger list.

The director of the expedition, Prof. Clark, has given up the presidency of the Amherst Agricultural College in order to lead this novel enterprise, which promises to be the precursor of a number of floating universities. Rev. H. W. Beecher, in a speech which he delivered in his usual happy vein, at a collation given on board the steamer, said: "There is nothing which could make me more contented than to be able to join this expedition myself. It makes me wish to be a boy again, that I might go with it around the world. There is so much more to be learned than can be gained from books; there are young men well enough off, who, from various circumstances, cannot go through college, and here they may learn something; there are young men who have gone through college, and want to know something, and this will be their opportunity; they are rich men's sons, with whom their parents are at a loss what to do; they can be put on board a vessel like this and be made men of; there are intelligent, saving men in the trades and professions who desire to increase their knowledge, this will give them their opportunity."

We wish the undertakers of this novel enterprise all the success they deserve, and the professors and students a happy return to their homes, with a rich stock of knowledge of a kind which they could not obtain so well otherwise.

The New Sewage System of Boston.

Many parts of Boston are very unfavorably situated for drainage, being only a few feet above low water, so that not only do the sewers not freely discharge, but the rising tides back the sewage matter up, and keep it stagnant in the sewers, which is one of the great causes of injurious emanations, as it has been found that if such material, diluted with water, is not removed within twenty-four hours to a place where it will be out of harm's way, very serious results, in a sanitary point of view, may be the consequence. Another serious defect is that the existing sewer outlets are all in close proximity to a dense population, some of them in the heart of the city, close to hospital and free bathing houses.

It is now proposed to remedy both of these evils at once, on a plan similar to that followed in London, Berlin, Dantzic, and other European cities, by building intercepting sewers along the margin of the city, lower than the existing sewers, into which the latter empty; a main sewer, lower still, which receives the flow from the intercepting sewers, and which, crossing the city, leads to a pumping station; pumping machinery to raise the sewage some 40 feet, an out-fall sewer through which, after having been raised, the sewage will flow to a storage reservoir on Moon Island, from which it will be let out at high tide to be carried by the outflowing current well outside the harbor.

The materials used are bricks laid in hydraulic cement; sometimes a plank foundation is used, and in some places side walls of rubble stone masonry are required. For about a mile where mud was encountered it has been necessary to support the sewer on piles; in places where the sewer is so low beneath the surface of the ground as to make it economical, the sewer has been built by tunnelling. On the line of the sewers, at intervals of about half a mile, are built iron flushing gates, which can be closed, so as to cause the sewage to dam up behind them. These gates can be suddenly opened, and the accumulated sewage, rushing down with great force, will, it is expected, stir up and carry along any deposits which may occur.

This is a scouring out system, in very common use in Holland, not only for sewers, but even for harbors situated at tide water, where the high-tide water is stored up in a very large reservoir and kept locked up until low water, when the flood gates are suddenly opened and the whole mass rushes to the ocean and washes out the mud, which has a tendency to settle at the bottom at every slack of high tide, and finally obstructs the entrance and interior of the harbors or canals.

The intercepting sewers in Boston are to be made generally several feet below low water in the harbor; their inclination varying from 1 foot in 1,000 to 1 foot in 2,000, but always sufficient to maintain a velocity in them of over 2 feet a second, which, it is thought, will prevent serious deposits. They are provided with numerous entrances, by which the interiors can be examined at any time. The main sewer, into which the intercepting sewers empty, is from 7 to 11 feet in diameter, and has a uniform inclination of 1 in 2,500 feet, or about 2 feet to the mile. At the pumping station it is about 14 feet below low water, where it is proposed to have four steam pumping engines, so arranged that four more may be added when required. They will be about 175 horse-power each. At the pumping station the sewage, previously rid of all large floating substances, will be raised about 40 feet and pumped into elevated tank sewers, 1,000 feet long, extending toward Moon Island. These tank sewers will be arranged so that any silt or road detritus which may have passed the pumps, and which would be liable to cause deposits, can settle and be removed; what remains, consisting of water and light matter, will be allowed to flow at intervals through a tunnel at Dorchester Bay to Squantum.

This tunnel is to be about 135 feet below low water, and will be about 7,000 feet long. It will pass for its whole length through rock, part slate, conglomerate, the presence of which in the line chosen has been determined by 125 artesian borings. At the eastern end of the tunnel the sewage will, of course, rise to nearly the hight to which it was pumped. No fears are entertained of deposits occurring in the tunnel, as only light, easily moved matters will be allowed to enter it, and the velocity with which the water will flow from the tank sewers through it can be exactly determined and can be made sufficient to keep it clean. As a further precaution, it will be possible to apply a method used in France for finishing tunnels, which consists in passing through them a hollow ball of somewhat less diameter than the tunnel. The ball rolls slowly through the tunnel, bearing against its top, and in its passage closes up most of the area through which the water passes. The latter, forcing its way with great violence past and under the ball, stirs up and carries along any deposits.

At Squantum the sewage will rise to a level a little lower than the tank sewage at the pumping station, and will flow through a sewer built on an embankment to Moon Island, where it will pass into a reservoir. The reservoir will cover about four acres and will be arranged so that eventually it can be enlarged to double that size. It will afford stowage for twelve hours' supply of sewage, and its floor will be high enough to let the contents flow out of it at high tide. It is intended to empty the reservoir into the sea during the first or second hour after high tide. At that time a strong current sets outward past Moon Island, which experiments with floats show will carry the sewage between Long and Rainsford islands, through Black Rock channel to the vicinity of the Brewsters, well outside of the inner harbor. This may be further explained by the engineer's report: "It is supposed that on its return with the flood tide the sewage would be so diffused as not to be perceptible; most of it would probably return by Broad Sound to the vicinity of Deer Island, and with the next ebb would move still farther seaward, not again to enter the harbor. What would be its ultimate destiny is a matter of surmise. Fifty bottles, weighted and well corked, were put into the water at Moon Island, each containing a postal card addressed to our office, requesting the finder to mail it, stating when and where it was picked up. Of these seventeen were blown upon Rainsford Island, and ten more were picked up at intervals during the following three weeks; one of these was found in the vicinity of Marshfield, about 25 miles south of its starting point; a second at Salem, about the same distance north; and the remaining eight outside Cape Cod, near Provincetown, Wellfleet, and Chatham, from 50 to 80 miles distant. If the movement of these bottles may be taken as an indication of the diffusion of the sewage, it shows that in a few days it would be diluted to the point of practical annihilation, if indeed it were not actually destroyed by oxidation, or by being assimilated by the myriads of animal organisms which pervade the sea, and which constitute one of the most admirable provisions in the economy of nature."

Some of our daily papers most urgently insist upon New York adopting a similar system, but they forget that the circumstances under which the two cities are situated are widely different—almost opposite; New York is surrounded by water, a rapidly flowing river on each side, while Boston is built around irregular and stagnant inlets of the tide water. Our strong tides, sweeping both sides of the island, carry all sewage matter away, so that all we need is the more thorough emptying of such sewers as are situated in a few limited localities—so low as to allow the tide water to enter them. Most of our sewers are entirely above high tide, as most of the city is high with a few local depressions, while most of Boston is low, with a few local elevations.

The Abolition of Apprenticeship.

There are some who still deplore the fact that at the present day the old system of apprenticeship has become obsolete; but we think that the change in our custom should not be regretted, as it is the necessary result of changed circumstances, and, taken all in all, the advantages overbalance the disadvantages.

The changed circumstances referred to are the invention and universal introduction of new and improved tools and machinery. This has exerted a twofold influence, namely, it has upset the old routine way by which employers taught apprentices the old traditional methods, because new machinery made it necessary for the employer to continually learn himself some new way of doing a thing, at the same time machine work did away with the drudgery with which apprentices used to be charged and bored, resulting in a loss of much of their time without learning anything. The world has found out that it is much better to keep boys at school a longer time, when, after having received a more complete education, they will, on entering a modern shop at a maturer age, learn more of the business in three months than very young apprentices in former years used to learn in three years; and we need only point out this fact to convince any one of the advantages the youth of the present age enjoy in this country over the youth of years gone by, and over the youth in old stagnating countries of Europe. This is one of the chief reasons why we are at the head of all the world in useful, practical appliances, and generally acknowledged to be so.

What we have said applies to most all trades, especially to wood-working and carpentry, in which great improvements in machinery and tools have been introduced, which have resulted in another advantage, namely, the trade is much more readily learned, the improved tools making it easier to do good work, if the eye is only correct and the hand steady.

Improved Water Meter.

The continually increasing waste of water in cities where there is an abundant supply by well managed water works, is becoming a source of alarm; very natural therefore is the desire of the managers of such works for reliable devices to measure the water consumed, in order to have every one pay for the water used, as they now pay for the gas consumed. It would be a most powerful check against waste, and thus secure a more reliable and abundant supply in case of an emergency, such as the occurrence of a large fire. As it is now in most cities, the consumption is so great that during dry seasons the reservoirs are kept nearly empty, the water being drawn off as fast as it comes in. This has instigated inventors to exercise their ingenuity in devising improved means for measuring the water used, in a more reliable way than is done by the water meters thus far invented. Our accompanying engraving represents the result of the labors of Mr. W. B. Mounteney, of Chicago, Ill., who has obtained patents for the same.

Our figure represents a vertical sectional view, and shows that in each of the two compartments of the meter casing there are two thin cast-iron concave diaphragms A A, having radiating slots *a a*, and a straight flange *b*, conforming to the shape of the casing. The curve of the diaphragms next to the sides of the casing conforms generally in curvature to the side of the casing, while the diaphragms adjacent to the central partition are more abrupt in curvature.

The elastic diaphragms B B are cast or molded in such a shape as to have their lines coincident with the outer metal diaphragms when in their normal condition. The flange on the rubber diaphragms is extended sufficiently to pass in between the vertical joints of the casing and act as a packing when the sides are clamped together. Each of the outer metal diaphragms is provided on its side next to the casing with a strip or rib *d* from above the water-opening and curving downward to about the center, thereby creating a trough or tube for a water channel, to overcome deposits of mud or other sediment.

The rubber diaphragms are attached to the arms and rock-shafts D by means of levers D′, and these rock-shafts pass through the horizontal partition E near the top of the casing. At the points where they pass through the partition, the shafts are packed by means of a peculiarly constructed rubber thimble *e*; this thimble has a flange 1 on its upper edge, which is clamped to the partition by means of a plate 2, and it sits inside a cup-shaped depression cast in the partition-plate, and has its lower end turned inwardly up to one-half the length, as seen at 3. The diameter of the turned-up portion is precisely that of the rock-shaft D.

In the upper compartment of the meter, and over the mouth of the ingress pipe, is a diagonal perforated plate 4, provided with lugs 5 5, resting in sockets 6 6 in the upper side or cap of the casings, and its upper edge lying against spurs 7 7, so that when the cap is laid on the lower casing the perforated plate is secured, thus preventing any extraneous matter entering the meter from the water supply pipe.

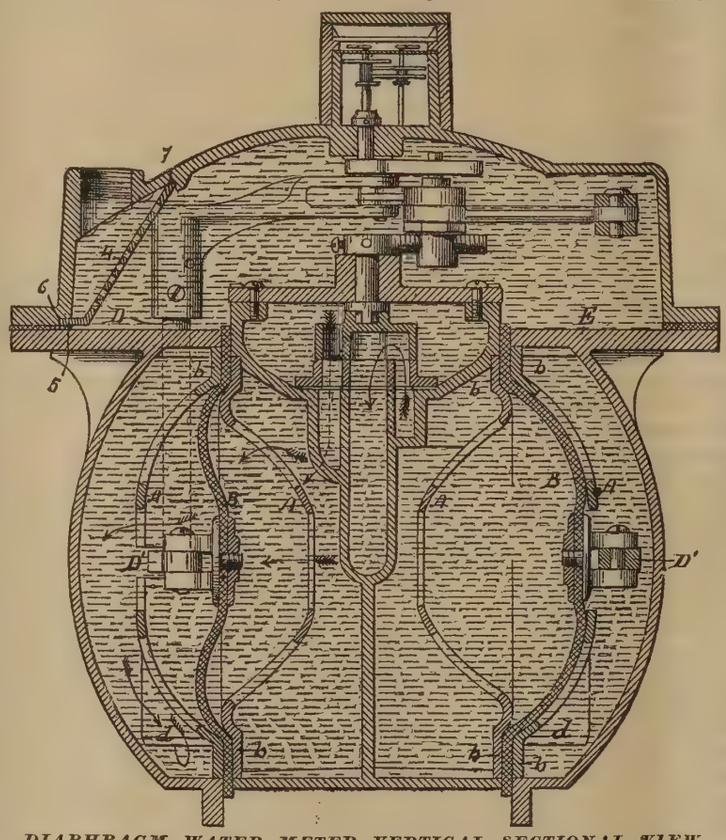
In the operation of the meter the slotted cast-metal diaphragms lead to a churning or agitation of the water, which prevents sediment, and when the meter is working under low pressure the slots lead to a more easy detachment of the rubber diaphragm's contact with the metal diaphragm.

The construction of the rubber packing around the rock-shafts allows the latter to operate without turning in the packing, but gives the packing a sort of torsional strain, allowing the shaft to remain always in close contact with the packing.

The merits claimed for this meter are, that it can be made cheaper than any other meters thus far in use, the high price of which has been the principal obstacle to their general introduction. Its use would at once result in a diminished cost of water, while now, by paying an equal tax, we all pay for the wastefulness of others. Another merit claimed is that it fulfills the requirements of a good water meter, which are: Mechanical perfection, reliable registration, certain and positive motion, without a dead center and a disposition to stop, and without the ineffectual expedients of tumbling-bobs, cranks, compensating valves and tubes, and elastic springs. It will at once be seen that a machine of such peculiar and delicate essentials is not easily obtained at a small expense.

But Mr. Mounteney has succeeded in obtaining all these requisites by the use of simple, unfinished castings, so as to reduce the expense. Notwithstanding this, the registering dial-hand will be seen moving as regularly under the lightest as under the fullest pressure. A cubic foot of water is as accurately measured when drawn by drops as when drawn through a ¾-inch pipe with full pressure; and this is precisely the feature in which all other cheap meters have signally failed.

Mr. Mounteney has his device patented in England, and this monopolizing the greater part of his time and attention, he desires to dispose of his United States patents, and will be glad to hear from parties wishing to negotiate for their purchase.



DIAPHRAGM WATER METER—VERTICAL SECTIONAL VIEW.

Theory of the Gyroscope.

In the New York *Herald* of April 4th, Mr. James McCarroll publishes a lengthy complaint in regard to our criticisms on page 63 of our March number. He appears to labor under the impression that we have not studied the subject sufficiently, while the fact is that we have investigated it thoroughly—practically and theoretically. We can show him various forms of gyroscopes, by Magnus, Fessel, Bohnerberger, Foucault, and others, with some original forms devised by ourselves, which would surprise him, as they have everybody who has seen them. We have lectured and written on them. Among those published we refer to several illustrated in some of our back numbers, (see pages 113, 133 and 157 of our May, June and July numbers for 1877).

This question cannot be disposed of by simply asserting that "a body is of uniform weight only when at rest." Even if this were true it would by no means explain the peculiar motion of the gyroscope; but the assertion which Mr. McCarroll wishes to be accepted as a new law of motion discovered by him, is utterly false.

The following communication, by one of our old pupils, exposes some of Mr. McCarroll's absurdities:

To the Editor of the Manufacturer and Builder:

Mr. McCarroll is very much disgusted with your remarks in your March number on his theory of the gyroscope. I suppose you anticipated this result. I have endeavored repeatedly to show him his error, but he cannot see it. There is one thing, however, about his "fourth law of motion" which you do not seem to understand, and no wonder; I have only just found it out by cross-questioning him. In the first place, he said:

"If a body is lifted upward the gravity decreases."

"But suppose it moves horizontally?"

"Then the centrifugal force neutralizes a portion of its gravity."

He not only mixes up two entirely different propositions, but all through his argument he ignores the difference between the absolute force of gravity and the resultant of gravity, and another force, (when convenient for his purposes). We find that the loss of weight by centrifugal force is truly appalling. I have made a rough calculation as follows: If a railroad train, weighing 200,000 pounds when at rest, were to move on a great circle at the rate of one mile per minute, it would lose about 2.3 pounds; hence it would only require the moderate rate of velocity of a few thousand miles a minute to reduce the weight to zero. People should remember this when they take out their fast horses, and not urge them too much, or they may fly off into space.

If we accept Mr. McCarroll's centrifugal force theory as a diminution of the actual force of gravity, then we must regard the weight of a body projected upward as a minus or negative quantity during the whole ascent, as zero when it reaches its highest point, and only becoming positive when it begins to descend. But this Mr. McCarroll does not do. He also tells me that he never claimed that his "fourth law of motion" had anything to do with the gyroscope. What does he claim? and what not?

New York, March 17, 1879. X.

That Irrepressible Keely Motor.

It is fortunate for Mr. Keely that he succeeded in inducing so many people to invest largely in his pretended invention, because it has afforded him the opportunity of keeping busy at it, many holders of the stock continually urging him to do something to galvanize the affair into life again.

It is now reported in the Philadelphia papers that for "many weeks and months Keely has been diligently at work building what he calls his 'vibratory engine,' which is to utilize the new motive power. This engine was completed a short time ago, and the directors and stockholders of the company, who had said that one revolution of it would demonstrate the practicability of his invention and insure their fortunes, claim that they are fully repaid for their long and anxious waiting by seeing it run for seven consecutive hours. Ten horse-power was developed, and Keely is now engaged in 'graduating' the engine, which peculiar process will enable him to intensify the action of the vapor and obtain almost any desired power. Upon the strength of the developments, a stockholder says that the stock has already advanced in price considerably."

The last mentioned fact is all the stockholders want to bolster up the stock, and the mere mention of it in the report shows the spirit that underlies the whole affair as it now stands. We fear, however, that it is too late, as we very much doubt whether any one can still be found so foolish as to throw money away so recklessly as to buy Keely motor stock. However, there may be some parties in out-of-the-way places who never read papers, and have saved a little money, who may by false representations be induced to invest.

It is a pity that there is no way to prevent, nor law to punish such swindling.

Special Uses for Different Peculiar Kinds of Woods.

In answer to several inquiries we here give some additional special uses for which many peculiar kinds of wood have been found to be by preference adapted. For some of these items we are indebted to the London *Timber Trades Journal*.

Spruce.—As stated in answer to Query 2308, on page 71 of our March number, this wood is used for the top boards of violins, guitars, and sounding-boards for piano-fortes. Its more common use, however, is for beams and posts, it being light and strong.

Maple is used for the backs of violins and guitars; but most of it is used for carpenter's tools. Sugar-maple is used by wheelwrights for axle-trees and spokes, and for the lining of runners of common sledges; while red maple as well as sugar-maple are used for saddle-trees. Maple is also used as a substitute for boxwood for wood type and coarse wood-cuts.

Boxwood, imported principally from the Mediterranean, is mostly used for engraving upon and making wood-cuts. For this purpose the trunks are cut into transverse slices of about 1 inch thick, and after being thoroughly seasoned, they are further cut up into rectangular pieces, and glued together if large blocks are wanted; in all of which the fiber stands on end, so that the engraving tool will cut no fibers. Boxwood is also used for making fine ornaments, either carved or turned on the lathe, for this purpose standing next to ivory. Printers' quoins and shooting-sticks are also often made of boxwood.

Ebony.—This is chiefly used for ornamental work and expensive furniture; but as its appearance is easily imitated by staining other hard woods, it is not in such general favor as it used to be in olden times.

Dogwood.—As this has a very tough and equal texture, being almost as strong transversely as longitudinally, it is a favorite wood for turners for making wooden chucks, screws and nuts for book-binders' presses, small vises, mallets, handles for light tools, etc. Farmers use it for harrow teeth, the harness of horse collars, etc.; also, being naturally smooth, for the runners of light sledges.

Tulip was used from time immemorial by the Indians for canoes. It is now much used for wooden bowls, the heads of hair brooms and sweeping brushes, and for eating and drinking troughs for cattle.

Holly.—The wood of the holly is principally used as a substitute for ebony. It is dyed black and used for the handles of metal teapots; the strong straight shoots are deprived of their bark and made into walking sticks and whip handles.

The *Lime Tree* forms the best planks for glovers and shoemakers to cut leather upon, and is used in the manufacture of toys, pill boxes, etc., while the inner bark is made into ropes and matting.

The *Orange Tree* is the finest wood for tooth picks, and is used for many other purposes.

Sycamore, besides being occasionally used for the backs and sides of violins and guitars, is used for mangles, cider and cheese presses, wooden dishes and spoons; also for beatling beams in printing and bleaching works, and for patterns in iron foundries.

Yew is used for turning snuff boxes, vases, and for musical instruments. It is not subject to rotting in the ground, and lasts longer under ground than any other kind of wood; it is therefore used for posts, water pipes, pumps, etc., while in France it is used for axle-trees, for which it is claimed to be better than any other wood.

Beech is used for planes, screws, shoe lasts, wooden shovels, stocks of muskets and fowling pieces, and for staves of herring barrels.

Horn Beam is used for cogs of wheels, and the very best for this purpose, much better than yew or crab. It is an excellent fuel, perhaps the very best of all kinds of wood, burning surprisingly long and giving an excellent charcoal, preferred in Europe for the manufacture of gunpowder.

Sweet Chestnut is used for gate posts, railings, hop-poles, barrel staves, etc., while in Switzerland and Spain the charcoal made from it is considered the best for forges; we, however, think oak charcoal better for domestic purposes.

Scotch Pine.—This is used for corduroy roads in Russia. The trunks being laid flat and close together across the road, alternately with the tops on one side and the other, the green tops are left on the tree, and form a hedge on each side of the road. Pine is also used for printers' reglets.

Larch is used in Germany for wine casks. It is claimed to be next to indestructible, and also that it prevents the evaporation of the alcohol through the pores. In Switzerland it is used for vine props, which last longer than the vines they support. In France this wood is used for water pipes.

Butternut is used for posts and rails of fences, troughs for cattle, wooden dishes, and corn shovels.

Hickory.—Shell-bark hickory is used for baskets, whip handles, and back bows of chairs; while pig-nut hickory is considered in this country the best for axle-trees, ax handles, and the circle around sieves. The best quoins and shooting-sticks for printers are made of hickory; they last longer than those made of boxwood.

Cherry is preferred by printers for furniture, reglets, side-sticks, etc., being far better than pine, which is also used a great deal, being cheaper.

Laurel resembles boxwood, and is used as its substitute for handles of light tools, little boxes, small screws, etc.

Birch is used for bowls and trays, and the young branches as hoops for rice casks. The twigs of the red birch, which are stronger than those of other kinds, are used in Europe for common brooms. The black variety is used for shoe lasts, but are inferior to those of beech.

Alder.—The European variety is there largely used for wooden shoes, especially in France. They are made while the wood is green and wet, seasoned, and dried afterward.

Locust is also a substitute for boxwood, and used by turners for making spoons and forks for salads, sugar bowls, salt cellars, candlesticks, boxes, and other small articles.

Olive is used for light ornamental articles, such as dressing cases, tobacco boxes, etc. The wood of the root is considered especially valuable, and used as veneer and for inlaying, being most beautifully marbled.

Persimmon is the best article for the mallets of tinmen, large screws, shoemakers' lasts and the shafts of carriages; it is preferred to ash for the latter purpose.

Lancewood is the very best for handles of lances and for shafts of chaises.

Elm is used for cannon carriages, the gunwale and blocks of ships. The naves and felloes of wheels being preferred by wheelwrights of this wood.

Cedar.—White cedar is used for wash-tubs, pails, and churns; its advantage is that it always looks clean, and instead of growing dull and dark by age it becomes whiter and smoother from use. The hoops are made of young cedars, split. It makes a good fuel and an excellent charcoal. Red cedar is used for staves, stop-cocks, stakes, boxes, etc., and in Europe often for coffins.

Gum.—The sour gum is the best wood for hatters' blocks, while the sweet gum is sometimes used for picture frames.

Willow is used for baskets.

Ash is used for the bottom part of sieves.

Encouraging Prospects for the Iron Trade.

It is certainly a cheerful sign says the New York *Commercial Advertiser*, when the American iron-makers allow themselves to say that their trade is promising and that they do not need any addition to the tariff to protect them from foreign competition. Though the entire number of furnaces in the United States decreased during the year by 16, and the number in blast by 10, the total production showed a very considerable increase. The stock on hand is also less than at the close of last year, and the net increase in consumption is not far from 200,000 tons. This state of things, of which some further illustrations will be found in the dispatches referred to, is explained by some special causes which have been in operation, and also, perhaps mainly, by the general revival of business, the commencement of which is generally acknowledged on all hands.

Cheapening Fire-Proof Buildings.

Experience has shown that supposed fire-proof floors supported on brick arches springing from iron beams, fail to stand the intensity of a great conflagration, the beams warping and springing, the arches crumbling to pieces and allowing the floors to fall. In the buildings where corrugated iron ceilings are used, the arches remain almost uninjured by fire and require little more than painting to put them in good condition again. The arch of corrugated iron formerly made rested upon iron girders, which, although they did not require to be as heavy as the girders for supporting brick arches, were nevertheless heavy and costly, and this expensiveness prevented the introduction of the corrugated iron ceilings, into many classes of buildings in which they certainly would have been used but for the cost. That objection has now been obviated and the cost of construction of these ceilings and floors, largely reduced by substituting for the rolled iron beams, perfectly protected wooden beams, the exposed parts of which are enclosed in a casing of mortar and a sheathing of iron. The improved ceiling has received the endorsemennt of the architects of Chicago in a public meeting, at which it was stated that the cost of these new ceilings having wooden beams, corrugated arches and mortar or concrete filling, was but little more than for the ordinary finish of wooden ceilings for storerooms. The sheathed or cased beams cost only one-ninth as much as the iron beams, even at the present low rates for iron. The object of fire-proof construction is to confine a fire to the room in which it originates, but, as the Chicago and other large conflagrations have demonstrated, a fire-proof building may be destroyed by a fire exterior to it or one which develops enough heat to crumble stone and brick work. In other words fire-proof construction must be generally introduced before it can avert the dangers of such sweeping conflagrations as those of Chicago and Boston; hence the importance of any improvement cheapening the cost of fire-proof ceilings and floors and making them available in all classes of buildings.

A Dangerous Enterprise.—A great work now in course of execution is the lighthouse of Ar-nien, on a rock beyond the Isle of Sein, off Cape Finisterre, (Land's End), Brittany, western France. In 1860 a commission was appointed to inquire into the possibility of constructing a lighthouse at this point, where the currents were so tremendous that even in the calmest weather they cause a very heavy sea in certain directions of the wind. The rock is of hard gneiss, from 40 to 50 feet in length and about 25 in breadth. The preliminary work was done by fishermen of the Isle of Sein, whose familiarity with these waters enabled them to reach the rock when no one else could. Their method was, when opportunity offered, for two of them, wearing cork belts, to get out of their boats and lie upon the rock, which they clutched with one hand, while they made holes at intervals of 3 feet with the other. Meanwhile they were covered with spray, and sometimes carried away to be recovered by a boat. In 1867 only 8 hours' work could be accomplished, and 15 holes made; the next year 40 holes were made. In 1869 the building was begun, and now the tower is 40 feet above the highest tides, but it is intended to be about 90 feet.

Reversible Blowers and Exhaust Fans.

During the last four months, so many orders have been received for the Sturtevant blowers and fans that it has strained the capacity of the works to their utmost capacity to fill them. This is either a sign of their special excellence, or of a great revival in manufacturing industries using them, or of both, which is actually the case.

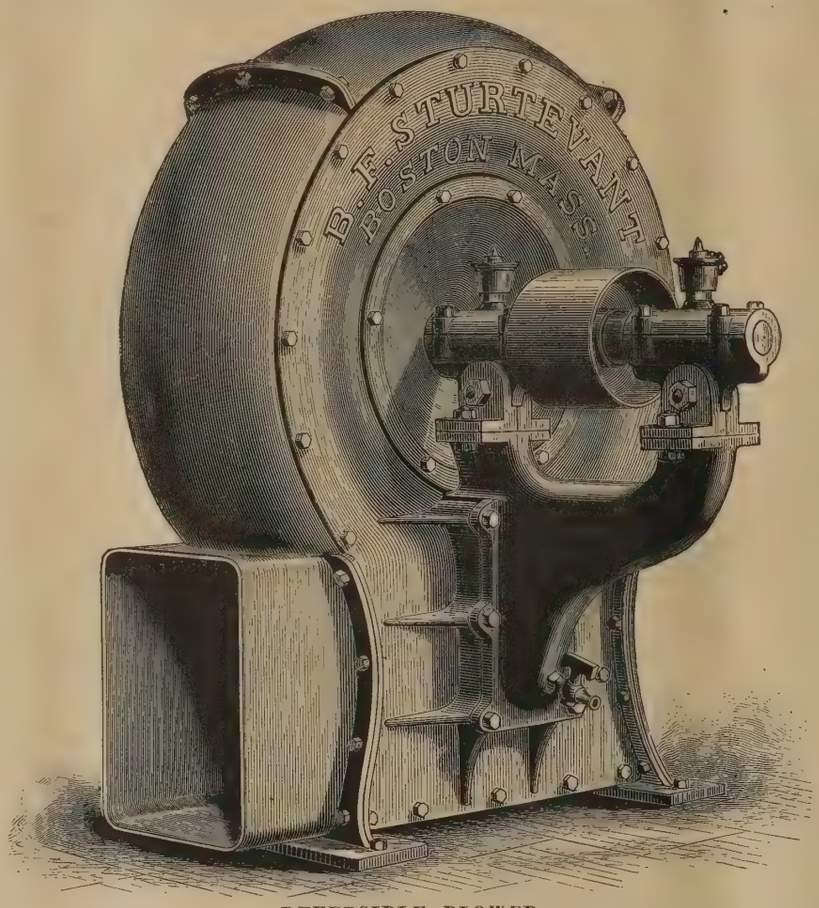
Mr. Sturtevant has his office at 72 Sudbury street, Boston, while his factory is located at Jamaica Plain, Station Ward 23, Boston, where over 100 men are employed, together with a great variety of labor-saving machines, of which the blower itself is one of the most interesting.

The blower represented in the adjoined engraving has a reversible outlet or mouth-piece, by changing which the delivery pipe can be attached and the blower run in either direction, so that with simple change of position it will draw from either side, and with change of mouth-piece will deliver to suit the user. Thus the inconvenience and delay often experienced in having to wait for a blower to exhaust and deliver the right way is avoided. This kind of blower is made in 22 various sizes, marked from No. 20 to 41, and varying in size from 8 inches in diameter to over 10 feet, and in price from $7 to $1,000.

It is but a short time ago that this kind of air blast was used for limited purposes, being chiefly confined to furnaces and forges for working metals, and in connection with them steam boilers. Coarse fans constituted the mechanical device, or in cases where an especially strong blast was required, ordinary pumps were employed. To supply this manifest deficiency, Mr. Sturtevant invented the blower in 1867, which was subsequently illustrated in our columns. Since then thirty patents upon the original form have been granted, and so widely has the manufacture become extended, that no less than 20,000 are now in use.

Among these are pressure blowers for blowing forges of all sizes and kinds for working iron, steel, gold, silver and copper; also for blowing reverberatory furnaces, heating and puddling furnaces and nobbling fires. This blower is also used for blowing furnaces for melting steel and other kinds of metals in crucibles; for cupola furnaces for melting iron, brass and copper; for steam boiler furnaces where fine coal is used, and especially where coal-dust or screenings, or wet tan or sawdust is used for fuel. In addition to burning cheap fuel, the blower adds to the capacity of the boiler for making steam, by means of the more rapid currents through the tubes. The pressure blower is also used for supplying jets of air, or open air blasts for blowing on to and cooling hot molds in the manufacture of glassware; for cooling employees who are compelled to work very near hot furnaces and forges in glass and iron works, hotels and restaurants, especially in hot climates. By the aid of a blower a man or woman can be kept very comfortable within two or three feet of a red-hot furnace or cooking range; these blowers are also used to give jets of air for blowing sawdust from logs in front of saws, thus preventing the saw-teeth from clogging. The construction of these blowers is such as to adapt them to all varieties of speed and power, and for every possible duty. The sizes range from 250 cubic feet a minute to 500,000 cubic feet a minute, the largest being 2,000 times larger than the smallest; the sizes which exceed the capacity of 50,000 cubic feet per minute are not built portable, the housing being constructed of brick and stone.

The exhaust fans are employed for removing shavings from planing and molding machines; sawdust and dust from sand wheels, such as are used for polishing lasts, carriage spokes, shoe bottoms, felt hats, etc., and emery wheels, for polishing all kinds of hardware; smoke and gas from smith shops, manufacturing establishments, and chemical works; steam and vapor arising from paper machines, drying cylinders, and dry-rooms; sweat from mill stones, offensive odors from try kettles and dyeing establishments, dust from rag and cotton pickers, flax and rope machinery; ventilation of coal mines and underground apartments or cellars, and for exhausting impure air from public buildings of all kinds. Two of these fans are already in use in the United States Senate Chamber, and two in the House of Representatives, driven by very powerful engines, and capable of removing 1,800,000 cubic feet of foul air per hour.



REVERSIBLE BLOWER.

Pneumatic despatch blowers are arranged for conveying and elevating packages.

Hot blast blowers are used for taking the hot volatile product of combustion from large boiler chimneys, and forcing it into kilns for drying non-combustible materials, such as fertilizers, brick, etc.

Steam heaters and blowers (combined) are employed for blowing under beds of wet wool, cotton, cotton-waste, and wadding, into machines for drying wet cloth and hosiery; into kilns for drying lumber of all kinds, staves for barrels, tubs and pails, clothes pins, brick, grain, tobacco, sliced fruit and vegetables of all kinds, chemicals, glue and gunpowder; and for drying leather and skins in tanneries. These machines not only supply the necessary heat for evaporating the water from the substance to be dried, but the great energy of the blast expels the moisture from the dry kilns, keeping them thoroughly ventilated and filled with dry, hot air.

Cold blast blowers are used for drawing currents of air through boxes filled with ice applied to refrigerators and chill rooms in markets, hotels, on railroad cars and steamships, for the preservation of fresh meat during transportation, etc. These are generally termed "exhausters," being provided with a supply pipe leading from the boxes to the blower. They are also extensively used in slaughter houses.

The condensers are employed for condensing the moisture in the air, rendering it comparatively dry, cold, and free from fungus. These condensers are usually constructed of coils of pipe filled with cold running water, over which the air currents are forced by the blower. They are also constructed on the same principle as surface condensers on board ships, the air currents being forced through a large number of tubes surrounded by cold water.

An Absurd Rapid Transit Plan.

A circular has been sent us by Mr. G. L. Haussknecht, of Brooklyn, N. Y., containing a plan for rapid transit, which is called the "silent, practical, reliable, safe, one-rail elevated inclined plane, rapid transit road; simple, permanent, economical and ornamental construction; natural, reliable motor; economical and simple manipulation; fare 5 cents; no damage to property, no dripping."

The inventor proposes stationary engines and endless ropes resting on stationary wheels, while "the conductor grapples the rope to start, or releases his grapple to stop;" . . . "the cars going downhill will balance those coming up. The power required is for motion and speed." This power is to be "supplied by gearings at the ends, and compressed air travelling to the various sections, entering a rotary fan drum, setting the large driving wheels with ropes in operation," etc.

The road is to have many inclined sections of 25 feet to the mile, down which the car is to run 20 miles an hour by its own gravity; at the end of each section there is to be a station, where the car is lifted up again to the head of the next section by compressed air, furnished by an engine situated at the end of the road, the compressed air being transmitted through the inside of the rails, which are tubular, while the wheels, which have hollow flanges, are placed above the cars, which hang balanced below, one on each side of the track.

The cost is not to be more than $75,000 per mile, while the iron and wood used is to be chemically prepared, so that the iron can never rust and the wood never burn.

If this inventor were acquainted with the drawbacks connected with the system of drawing trains by endless ropes, and had seen how it has been gradually abandoned in every case where it was possible to apply the motive power in another way, he would not think of applying it in a case like this. Does he not know that this was the plan upon which the Greenwich street elevated railroad was first worked; that it was given a fair trial, and that after so many thousands of dollars had been spent in experimenting as to bankrupt the whole concern, it was finally abandoned as valueless for the purpose?

To Tin Zinc.—Make a bath of distilled water, 1 gallon; pyrophosphate of soda, 3½ ounces; and fused protochlorid of tin, ½ ounce. A thin coat of tin can be obtained by simply dipping the zinc in the bath, and one of any thickness by the aid of the battery.

Bacon's Double Cylinder "Special" Hoisting Engine.

Among the various kinds of hoisting engines, made for special purposes by Messrs. Copeland & Bacon, of 85 Liberty street, New York, stands prominently the double cylinder "Special" hoisting engine here illustrated. It is designed especially for light work, to be accomplished at a fair rate of speed, such as has to be performed in coal yards, fish and oil factories, by ice companies, oyster packers, in ash hoisting on board steamers, etc.

The drum is driven by friction, and the mode of operating (which is performed with one lever) is done as follows: To hoist, the friction wheels are thrown in contact, and the drum will then revolve and wind up the rope. When the friction wheels are out of gear, the drum being loose on the shaft, will allow the weight to overhaul the rope and be lowered. By a slight downward pressure of the hand lever the large friction wheels are thrown against a shoe brake, which controls the load in lowering or holds it at any desired point.

Copeland & Bacon have just issued a new illustrated catalogue, containing a few of the many different styles they build, which they will be pleased to furnish on application.

The East River on Fire.

At the foot of 65th street, North River, this city, the Standard Oil Company have storage tanks for crude petroleum, delivered there by the railroad trains. The greater portion of it is passed through a pipe about three miles long, passing under the streets of the city to the East River, and then under the river to the distilleries at Hunter's Point. Through this pipe the oil is forced by a steam pump.

On Sunday morning, April 20th, the pipe bursted on the bottom of the river, and the oil and water rose like a water-spout, covering the river with petroleum, which spread in all directions, and was carried down the stream by the ebbing tide. From some cause the oil took fire along the river front, and in a moment the New York shore was in a blaze; fortunately there were scarcely any vessels on the river, but one of the docks took fire, which was promptly extinguished by the firemen. The oil of course could not be extinguished, and burned until it was consumed. The quantity on the water was spread over such a large surface that it did not burn long, but the flames shot up here and there as they travelled rapidly from one floating quantity of oil to another. When the fire reached the spot over the leak it remained confined there and burned for four hours. No serious damage resulted, some vessels and fences and trees along the shore being only slightly scorched. The most serious damage was to the dock on the New York shore.

Reform in Weights and Measures.

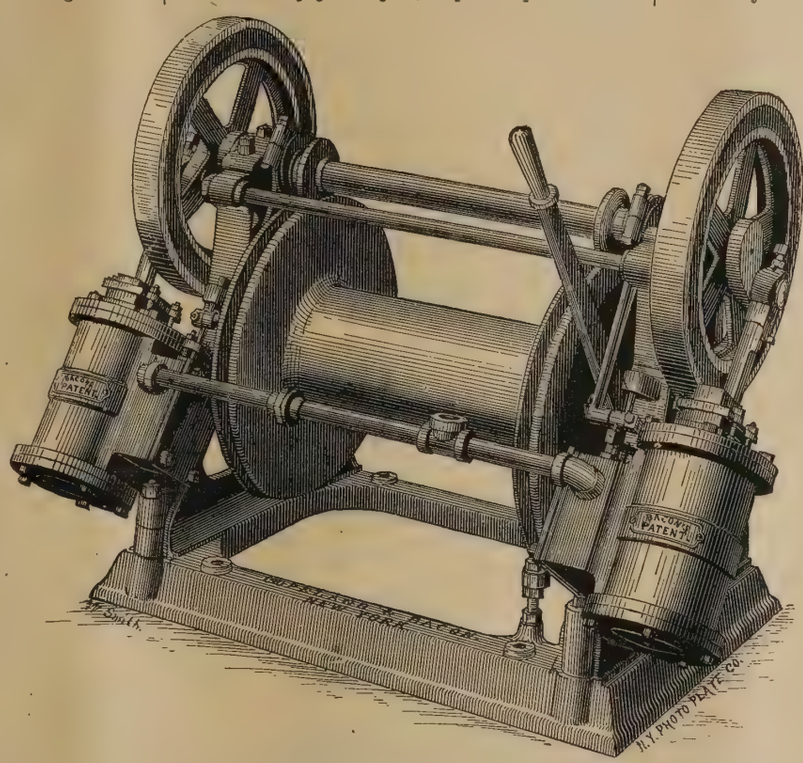
We are all aware of the inconvenience of our existing absurd and incoherent system of weights and measures. With the continual extension of business it has commenced to be felt so much in England, that in that extremely conservative country a movement is at last on foot to establish a reform; but instead of adopting the beautiful and consistent metric system, which has now been adopted by nearly all other civilized countries of Europe, and bids fair to be universally adopted in the United States, their old national pride prevents them from adopting anything foreign, especially if it be of French origin, and this is the defect of the metric system in the eyes of every patriotic Englishman. The result is the proposal of a slight—not even half way—measure. The movement heralded in the papers consists in making the centner weight 100 pounds avoirdupois instead 112 pounds, the ton 2,000 pounds instead of 2,240, and to divide the centner into 50, 20, 10 and 5 pounds instead of 56, 28, 14 and 7, as it now exists.

Now, what does this amount to? To nothing, if we look at the thorough reform needed in weights and measures, at the uncertainty of all our standards, and the irregular jumble of the divisions of our measures of length, of surface, of bulk, etc. All that we have improved thus far is our monetary system, and instead of pounds, guineas, shillings and pence, we have dollars and cents, our dollar being divided into 50, 25, 10 and five cents. This is what we want for our yard, mile, bushel, gallon, pound, ton, etc. The movement among us which the papers report, to patch up our centner weight and ton, in imitation of the movement on foot in England, is too much of the old weakness of aping Great Britain. If we continue doing this, we will fall behind in many respects in the world's struggle for advancement.

It is in more than one respect that this danger threatens us. While we ignore the claims of tax-paying women to their right to vote, we see in the reports from Japan that a lady in the Southern Provinces protests against paying taxes until she is allowed to vote. Her letter, which is stated to be pertinent and to the point, even in Japanese estimation, has been referred by the local authorities to the central government, and a favorable decision is expected.

Perhaps it is not known to many of our readers that for about two centuries Holland was the only nation privileged to trade with the exclusive Japanese, that the Dutch language has for this reason been much studied there, and that in Holland the right of women to vote has never been disputed, many availing themselves of this privilege on such occasions when they think it to be a matter of importance.

Let us therefore not remain behindhand, even if Holland and Japan give women the right to vote. Holland has for fifty years used the metric system, while Japan is following suit. Let us then not ape England, but go for thorough reform, and unite with Chicago, from which city an opposition to the patch-work above referred to has been developed; it is true, not with the view of adopting the metric system instead, but from conservatism; we like such conservatism, because half-way measures only tend to retard reform, and the more carefully we preserve the defects of existing systems the more hope there will be for thorough reforms in the end. So mote it be.



DOUBLE CYLINDER "SPECIAL" HOISTING ENGINE.

Pneumatic Dispatches in New York City.

Some time ago a brass tube was arranged vertically along the wall of our office, passing from the street upward to the editorial rooms of the New York *World*, which are situated above the offices of the MANUFACTURER AND BUILDER. The same was done in the buildings occupied by the *Herald*, *Times*, *Tribune*, *Sun*, and *Staats Zeitung*, all situated in an almost straight line, over a distance of less than 1,000 feet from the Western Union Telegraph building.

At present workmen are digging up the street in order to lay a series of tubes, six in number, one for each office. These tubes are all drawn seamless, have a diameter of 1¾ inches, and are connected below with the upward running tubes in the buildings mentioned, all ascending to the top stories, which are usually occupied by editors and printers. At the Western Union Telegraph office a powerful blower is connected with the ends of the tubes, where the messages are enclosed in felt-covered leather boxes, fitting closely within the tube, which are forced through by an air blast, and, arriving at the newspaper office, will strike a metal button, thus closing an electric current which will cause a bell to ring at each end of the tube. A pressure on the button will indicate the return of the empty box to the telegraph office, when a vacuum pump is applied.

The telegraph company has at present two lines of pipe in operation—one extending to 134 Pearl street, and the other to the Stock Exchange.

What our Government does with the Public Money.

As an offset to the public improvements which the French government has inaugurated, we will give an extract of some items for which our Congress has voted funds.

An appropriation of $40,000 has been made to continue the work of compiling and arranging for publication the Confederate archives. A provision is made for restoring the Patent Office building, which was seriously damaged by fire about two years ago; and $30,000 are appropriated to improve the ventilation of the Hall of representatives. A similar amount was spent for the same purpose two years ago, without any result.

Congress has been very liberal in voting the money of the people to pay the numerous contestants for seats. Corbin, who should be Senator from South Carolina instead of Butler, gets $10,000, and the following members of the House whose seats were contested, are given the sums set opposite their names, in addition to their regular salary of $5,000 a year, in order that they may be enabled to pay the expenses of defending their seats:

Shelley of Alabama	$2,500
Wigginton of California	2,600
Patterson of Colorado	237
Finley of Florida	1,262
Acklen of Louisiana	2,000
Elam of Louisiana	500
Robertson of Louisiana	750
Dean of Massachusetts	1,500

Metcalf of Missouri	1,700
Reilly of Pennsylvania	4,000
Rainey of South Carolina	2,500
Smalls of South Carolina	2,500
Jorgenson of Virginia	1,000

The following sums were paid to the men who contested seats, or who were turned out to admit their contestants:

Haralsen of Alabama	$2,500
Pacheco of California	2,000
Belford of Colorado	600
Bisbee of Florida	4,000
Darrall of Louisiana	1,000
Nash of Louisiana	1,000
Field of Massachusetts	1,500
Lynch of Mississippi	1,000
Frost of Missouri	2,000
Nutling of Pennsylvania	4,000
Richardson of South Carolina	2,000
Tillman of South Carolina	2,000

These liberal sums merely serve as temptations for future defeated Congressional candidates, and are seeds for future contests. Money was also appropriated to pay the families of deceased Congressmen the balance of the salary they would have received if they had lived, although newly elected members drew salaries also—so when a member dies two salaries are drawn.

Building Intelligence.

NEW YORK CITY BUILDING ITEMS.

On the south side of West Twenty-third street, a few doors west of Sixth avenue, there has just been completed an apartment house which will be known as the Wellington. The building, of brown stone, is upon a lot 25x100, and the structure contains five commodious flats, each having nine rooms. The front entrance is ornamented with pillars of Aberdeen granite, especially imported from Scotland, and in accordance with the specifications carefully drawn before the contract was given out. The vestibule is tiled and trimmed with walnut. There is a fire-proof partition separating the kitchen from other parts of the house, and includes also the private stairway for the servants. Every room in the building is light and airy, a very convenient court-yard adding in addition all the air and light required in the various apartments. Of these apartments, those behind the dining-room are grained in oak, the dining-rooms are in ash, while the various parlors are finished in walnut and the bedrooms are painted in two tints. The late Griffith Thomas designed the plan for this house, which is owned by Mr. Benjamin F. Spink.

The condensed tabular statements of the Department of Public Buildings show that during the past eleven years, ending December 31, 1878, there were 6,270 first-class houses erected in the city, involving an outlay of $100,817,750. The First, Second, Third, Fourth, Eighth and Eleventh wards did not in all that time have a single first-class building erected within their limits. The Fifth, Seventh and Tenth wards had but one building each; the Thirteenth had 2; the Sixth 3; the Fourteenth 4; the Fifteenth 11; the Seventeenth 12; the Ninth and Sixteenth had 38 and 23 respectively, showing the filling-in of that old section of the city; the Eighteenth 33; the Twentieth 63; in the Twenty-first 176, and in the Twenty-second 820 are recorded, and for the last five years, when returns were received from the annexed wards, the Twenty-third returned 81 and the Twenty-fourth 1 such building. The real living quarter of the city is seen in the returns of the Nineteenth ward, running from Fortieth to Eighty-sixth streets, and from the Twelfth ward, lying adjacent to it on the north.

Ground has just been broken on the southeast corner of Fifty-seventh street and Sixth avenue for a building which is original in its conception, and will be unique in its construction—namely, a domicile wherein the bachelors of New York will find all the comforts of a home. The building will be of brick, with granite and iron trimmings, and seven stories high. There will be fifty-six suites of rooms, thirty-six of which will be arranged to suit the demands of artists, while the remaining twenty will be for bachelors generally. The suites for artists will each contain one studio room 18x26, one parlor 14x18, one bedroom 12 x16, and one reception room 5x10; while the suites for the other bachelors will each consist of one parlor, two bedrooms, a bath-room, wardrobes and closets. The building will be completed and ready for occupancy toward the end of this year. The interior will be finished with oak, ash and cherry. Mr. John Sherwood is the owner; he employs no architect, the design for the building being peculiarly his own.

THE EFFECT OF RAPID TRANSIT.

Many families have returned this spring to make New York their residence again, who in past years were driven from it by high rents. The return of households may not yet be great enough to have a very marked effect on the coming census of the metropolis, but it is sufficient to show that the tide has changed and that New York is no longer rapidly building up the cities across the North and East rivers at its own expense. Of course it is rapid transit that has drawn these people back to New York, and with the increase of dwellings for their accommodation, which is now going on, and the extension of the means of reaching them, we may expect to see the number of those who are returning to the city growing greater every year. The migration from the lower to the upper part of the island—the region about Harlem—has been great this spring. If this advance northward continues, and it is likely to be increased each year, Harlem will within ten or fifteen years become one of the most populous parts of the city.

Meantime a wise movement is in progress in New Jersey to unite the railroads in a plan for improving and cheapening the facilities for transit to and from New York, and thus to invite further immigration to the State. The Mayor of Jersey City proposes the adoption of a plan which has been tried with satisfactory results by the Fitchburg Railroad, running out of Boston. It is that of issuing free passes for one year for the first occupants of new houses built along the railway routes, and the selling of half-rate single tickets to builders and workmen employed in constructing the houses.

The progress of building in the city is steady, though not yet as rapid as it was during the five years from 1868 to 1872, inclusive, when an average of nearly 540 specifications were filed during the first quarter of the year, against 393 for the same quarter of 1879. From 1872 until the present year the number of plans fell off to about 300 for the quarter. Of the 393 buildings begun or projected this year, all except about 100 are above Fortieth street, a fact which indicates the rapidity with which the upper part of the city is now being covered with structures. It is also significant that of the whole number very few are large buildings, two first-class stores costing $50,000 each being the largest, and the average cost is $8,000. There are, however, in progress and near completion in the lower part of the city some of the most extensive buildings for stores and offices on the island, and during the quarter 339 plans for alterations affecting 361 buildings were offered. During the first three months of the year 237 buildings were begun, 247 were completed, and on the first of March 672 were in process of construction.

These figures show that there is a healthy activity in the building interest, and explain the better spirits of the owners of unimproved land in the more northern wards of the city.

CHICAGO, ILL.

J. H. Kedzie is about to build a three-story stone-front store, with tenements above, 24 by 60 feet, at 362 West Madison street, to cost $6,000. George H. Edbrooke is the architect.

There is to be built on Aberdeen street, near Van Buren, a two-story and basement flat, 26 by 68 feet, for H. A. Goll. It is to have a limestone front, and will cost $4,500. Mr. Strippleman is the architect.

Mr. Strippleman is preparing plans for a four-story and basement building, 25 by 100 feet, for manufacturing purposes, for C. Feleiffer. It will be built of Chicago pressed brick, with stone finish, and will cost $14,000. It is to be erected on South Canal street, near Van Buren.

Wheelock & Clay are preparing plans for a two-story dwelling, 27 by 65 feet, on Michigan avenue and Twenty-seventh street, for R. M. Wells, to cost $6,000. It will be built of pressed brick and stone. Also two two-story dwellings, each 16 feet 6 inches by 56 feet, with limestone front, to cost $2,500. They are for J. S. Maltman.

The Union Mutual Life Insurance Co. intend building four model tenements on Prairie avenue, near Thirty-first street; each is to be two stories and basement high. In the basement are to be the laundry, store-room, etc. On the first floor will be the parlor, hall, dining-room, and staircase hall, the latter being at the rear of the parlor, thus leaving the entrance halls unobstructed. The front is broken by double courts between each pair of buildings, giving them the appearance of being separate houses. Wheelock & Clay are the architects.

DETROIT, MICH.

The architects of the new Chamber of Commerce building are Messrs Lloyd & Pearce. The building is of brick and stone, measures 82 by 100 feet, and has cost about $50,000.

The improvements at the House of Correction will be commenced at once. The following buildings will be erected: One brick workhouse, two stories high, and 59 by 474 feet; a brick addition to the boiler-house, one story high, and 17½ by 52 feet; a dry-kiln of brick, one story high, and 32 by 15 feet; a varnish room of brick, one story high, and 26 by 15 feet; water-closets and bath-room of brick, three stories high and 11 by 19½ feet; about 75 feet of brick wall on the north and east sides of the grounds, and a frame shed for storage purposes. The total cost of the improvements is estimated at $14,000. Julius Hess is the architect.

MISCELLANEOUS.

A new Universalist Church is to be built at Chatham, Mass.

The Ypsilanti Paper Company is building a new warehouse at Ypsilanti, Mich.

A five-story brick building is to be erected on Bates street, Detroit, Mich., to be used by Richmond & Backus as a wholesale stationery depot, and for manufacturing purposes.

Plans are now being prepared at J. H. Whittaker's office, Trenton, N. J., for two three-story brick houses for Mr, John Ferris, to be built on Hamilton avenue, Chambersburg, N. J. Also, for one two-story brick building for Daniel Scudder, to be built on Bayard street.

Ground has been broken in Garden City, Long Island, for the foundations of St. Paul's Cathedral School for boys. It is intended that the building shall be a fine one, capable of accommodating 300 pupils. It will have a frontage of 260 feet, with three wings, each 176 feet in depth. It will be four stories in hight—excepting two towers, which will be six stories—and will be in the mediæval Gothic style of architecture. The plans promise that it shall be the finest edifice of its class on this continent. Built of brick and brown stone, it will be fire proof, and in all its appointments it will be as near perfect as modern science can make it. It will have a huge swimming bath for the use of the pupils. The school will not be a charity one in any sense of the word, but will be so managed that the cost of education will be reduced to a minimum. It will, however, have a number of free scholarships. After this building for the boys' school is completed, another like it in all respects will be erected for the accommodation of the girls' school. The plans already determined upon for other buildings there includes a divinity school building and a residence for the Bishop of the Diocese of Long Island. The expense of these buildings is borne by Mrs. A. T. Stewart. The St. Paul's Cathedral school is to be finished and ready for occupancy by the first of January next.

Glass Dome Skylights.

Ordinary skylights cannot claim to be classed as architectural ornaments; on the contrary, when visible from the outside, they often actually disfigure a building. A skylight of tasteful design and of more or less ornamental appearance, is therefore desirable, and the three adjoined engravings are successful attempts to accomplish this result. They possess the additional advantage of admitting much more light than the ordinary style, and besides are provided with a ventilating arrangement in the top.

Fig. 1 is a ventilated glass dome (exhaust principle) fitted thereon: the glass may be obtained plain or ob-

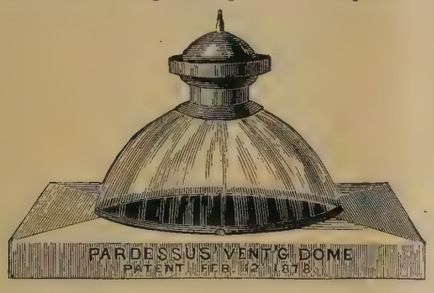


Fig. 1.

scured, with all the fittings needed to operate it. The ventilating caps may be 6, 7 or 8 inches neck, according to need. This style is made to conform to the curbing of old skylights, for dwellings, etc., and can be furnished at low cost compared to the important advantage it possesses in expelling noxious gases, preventing sickness caused thereby, and giving instead a pure, healthy atmosphere. The ordinary cheap wood hip skylight, with a ventilating tube inserted therein, is worse than none at all, (except for light), as it requires constant repairs, and deludes occupants with the idea that it ventilates the house.

Fig. 2 represents the same dome of plain or obscured glass, supplied without bases, to save extra expense in transportation, and enable buyers to adopt bases to suit their own fancy and cost. These domes work as efficiently on an inexpensive as a costly base, and are intended to suit all purses, and avert the danger of sickness engendered by a foul atmosphere.

Full instructions are furnished for placing the dome properly and securely, whether on metal, wood, or other foundations. They are supplied with all the necessary fixtures (and ventilator cap of 6, 7 or 8 inches) for operating them, according to need, and proper cement for securing them to whatever base may be used.

Fig. 3 shows a hip skylight of the bar pattern; it is mounted with glass of any thickness required, surmounted by the ventilating glass dome, plain or obscured glass, with ventilating caps 6, 7 or 8 inches neck, as desired, and furnished with all the fittings requisite for working it.

No dwelling, particularly with a low garret loft, is fit to live in without sure means being employed for making the atmosphere healthy. These ventilated (exhaust) skylights will cause the foul atmosphere in a house to yield to pure air, and prevent sickness caused by noxious gases or other unhealthy conditions. It is very natural that wherever used they have given complete satisfaction, as they will stand for years without repairs. This style is made of all sizes and dimensions, from 36 inches to 12 feet at the curb.

These skylights may be seen in operation in this city and elsewhere, where their working has proved to be very satisfactory. The sizes of the various domes suited to 6, 7 and 8 inch ventilator caps are, at the base, 19, 20, 21, 22, 23, 24, 25 and 26 inches in diameter, and for smaller ventilator caps 11, 12, 13, 14, 15, and 16 inches in diameter at the base.

The manufacturers of these skylights (which are secured by patent) are S. J. Pardessus & Co., of 9 and 11 Park Place, New York, who will send prices on application, when the measurements of curb or opening are given as a basis to estimate on. The time usually required to fill an order is from one to two weeks.

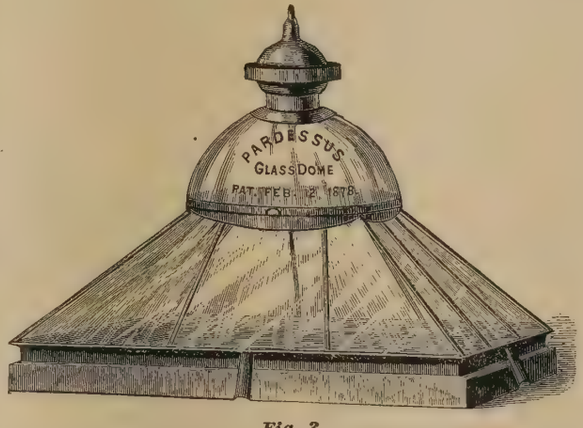


Fig. 3.

Bessemer Steel as a Competitor to Cast-Iron.

It was in 1866 that one of the principal iron masters in Philadelphia told us that he expected the time would soon come when Bessemer metal would take the place of other iron castings, as its cost of production could, and in course of time would be so far reduced as not to be much above the cost of cast-iron, while in quality it is so much superior as to make it to be decidedly preferred.

This has now come to pass. According to a recent report from England, Wilson, Cammell & Co., of Dronfield, near Sheffield, made a tender, which was accepted, for 25,000 tons of Bessemer rails for the North Eastern Railway, at $21.48 per ton. This is only a fraction more than a ton of pig costs in this country, and not as much as the pig for a ton of rails costs at many works. To us in this country it seems well-nigh impossible that steel rails can be made at $21.48, unless there are some economies in their manufacture which we have not yet learned. The works are admirably and economically managed; the pig is run from the blast furnace to the converter, and the converter and spiegel furnaces are so arranged as to save waste in runners. The arrangements in the mill are also productive of great economy; but how even there the cost of a ton of rails can be brought down to less than $22, is something we are quite unprepared to explain.

The recent statements of the French iron masters before the Commission on the Causes of Industrial Depression, throw some light on the question of cost of steel rails in Germany, that are invaluable. M. Jordan, a director of the blast furnace company at Marseilles, stated that it was possible at Krupp's works to turn out a ton of Bessemer pig iron for $13.50, and a ton of steel rails for $25.09, first cost. It is noteworthy, says the *Allgemeine Zeitung*, that the representative of Krupp's firm before the German Commission declined to give any information as to the cost of production. The other German rail manufacturers examined, estimated their cost of production at $30.25 per ton, exclusive of general expenses.

We do not know the cost of steel rails in this country, except in a general way, but think it would be safe to say that from $35 to $42 might be taken to be the cost at the works.

Malachite Green.

The following items, which we take from the *Chemical News*, show that there still exist many more methods of manufacturing new greens for dyes than have thus far been known:

"Up to the present, the so-called methyl green has been obtained from dimethyl anilin by converting the latter into violet by oxidation, and then the violet again by methylation into green. It has long been the endeavor of manufacturers of anilin colors to get the green direct from methyl anilin without going through the violet; and taking as a starting-point the theoretical and meritorious studies of Prof. A. Baeyer and Otto Fischer in Munich, and Oscar Doebner in Berlin, it has been found possible to produce green direct from dimethyl anilin, and even at a very low price.

These direct greens are brought into the market under the names of new fast green, malachite green, etc., and possess about the same chemical qualities; but the mode of manufacture and the attention paid to the same cause more or less difference in brilliancy of shade and yielding. It is, however, very easy to

Fig. 2.

distinguish direct greens from methyl greens through the simple fact that wool, silk or cotton, when dyed with direct greens, can stand a very high degree of heat without the green color turning into violet, while stuff dyed with methyl green turned violet when brought into contact with an iron exceeding 120° of heat.

The above theoretical mode of Otto Fischer was published in the reports of Berlin Chemical Society in 1877, under the title of "Condensation Producte Tertiärer Aromatischer Basen." He describes therein a new base, which he obtains by the reaction of dimethyl anilin, chlorid of zinc, and hydrid of benzyl, and further states that oxidizing the salts derived from his method led to the production of a beautiful bluish-green color. The exceedingly high price of the hydrid of benzyl has hitherto prevented the practical application of Fischer's most interesting discovery. Now, however, this material is produced at a price which renders its practical use quite possible.

The process of manufacturing malachite green is based upon the theoretical studies of Oscar Doebner, published in the reports of the Berlin Chemical Society, in 1878. Doebner proves in his report that green can be obtained direct from dimethyl anilin, chlorid of zinc, and trichlorid of benzol.

Besides the above-mentioned system of producing direct greens through the medium of hydrid of benzyl, there are other methods by which the same can be obtained—for instance, the product of the reaction of dimethyl anilin, chlorid of zinc, and dichlorid of benzol, submitted to oxidation, gives a very beautiful and cheap green.

Coloring Matter of Hair.—Mr. H. C. Sorby has succeeded in extracting the coloring matter from human hair. Diluted sulphuric acid he found the best solvent; he found that there are three coloring pigments—yellow, red and black—and that all the shades are produced by the mixture. In pure golden yellow hair there is only the yellow pigment; in red hair the red pigment is mixed with more or less yellow, producing the various shades of red and orange; in dark hair the black is always mixed with yellow and red, but the latter are overpowered by the black; and he found that even the blackest hair, such as that of the negro, contains as much red pigment as the very reddest hair. He concludes from this, that if in the negro the black pigment had not been developed the hair of all negroes would not be white or yellow, but as fiery a red as the reddest hair of an Englishman

Boilers of Short Duration.

A study of the remnants of the boiler described and illustrated on page 84 of our April number, is as interesting as it is instructive. When the boiler exploded it was torn into six principal parts, all of which are not shown in the drawings, as the drum was detached, and one long seam cut to facilitate its removal from the cellar.

It was found that the safety valve was not injured; it was then tested by means of an ordinary spring balance, and it left its seat at a maximum pressure (weight clear out) of 35 pounds per square inch. The

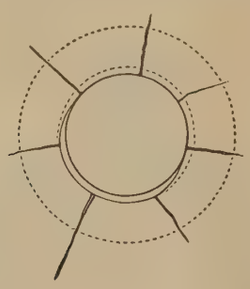


Fig. 7.

index hand of the steam gauge, having been carefully lifted over the zero stop-pin, took a position below the zero, a distance equal to the first 10 pounds of the scale above that point. It was afterwards carefully examined, and found to be perfect otherwise. No marks of over-heated tubes or plates were to be found, and there was pretty good evidence of a plentiful supply of water in the boiler at the time of the accident, (the safety valve was blowing six hours before the explosion). The escape pipe from the safety valve opened into the lower right-hand corner from the small semi-circular patch toward the front, (see Fig. 2, page 84), and a number of radiating lines deeply corroded around the stays, (Figs. 7 and 8).

No check valve was found to prevent the water from flowing into the heating pipes of the building in case the steam should have been carelessly shut off, without also shutting the valve in the pipe, by which the condensed steam (water) is returned to the boiler. It is not necessary to suppose this occurred, as there were ample causes for the premature demise of this over-doctored patient, without searching among the possibilities. The omission of the check valve, and the manner of attaching the steam gauge, may be considered bad pipe-fitting, for the buried return pipe is no more nor less than a part of the boiler, and may rust out, and any night empty the boiler through extensive leaks caused by corrosion, when, if no one is near, and there is a fire in the furnace, the boiler may at least be spoiled by over-heating.

Fig. 9 represents a plan of the cellar and boiler foundation, and shows the relative positions of the parts after the explosion, also the broken foundation piles of the building. Fig. 10 shows the details (full size) of the cast-iron sill and side plates of the boiler, intended to explain the effect of the "bellows" action of the plates. Solid matter having settled in the space between the plates when inflated, and the sill forming a fulcrum over the plates, in returning, act as a lever, as shown by the dotted lines. This action often repeated, the water acting rapidly within the disturbed fiber of the iron while inflated, a line of corrosion is formed inside, and the plate growing weaker by each repetition of the motion soon yields entirely and opens like a door. See Fig. 1, page 84, where for a distance of over 3 feet this action is easily discernible.

leaving it as shown in the sketch. Figs. 11 and 12 show the actual condition of many of the stays in this boiler.

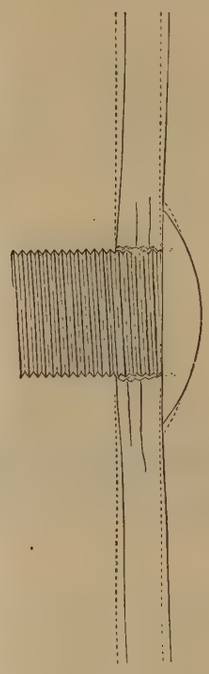


Fig. 8.

For the above illustrations we are indebted to the Hartford Steam Boiler Inspection and Insurance Co.

ANOTHER EXPLOSIVE.—Trials made with an improved blasting agent—woody fiber prepared with nitro-glycerin—in various mines in Upper Silesia, are stated to have proved, on the whole, not unfavorable, though the action was not in all cases regular. The substance has not, as claimed by the inventor, five times the force of an equal weight of ordinary black blasting powder, and even four times was doubtful—a threefold force however being plainly exhibited. The advantages claimed for the new agent are, less danger, as it does not explode on contact with open fire, and is by no

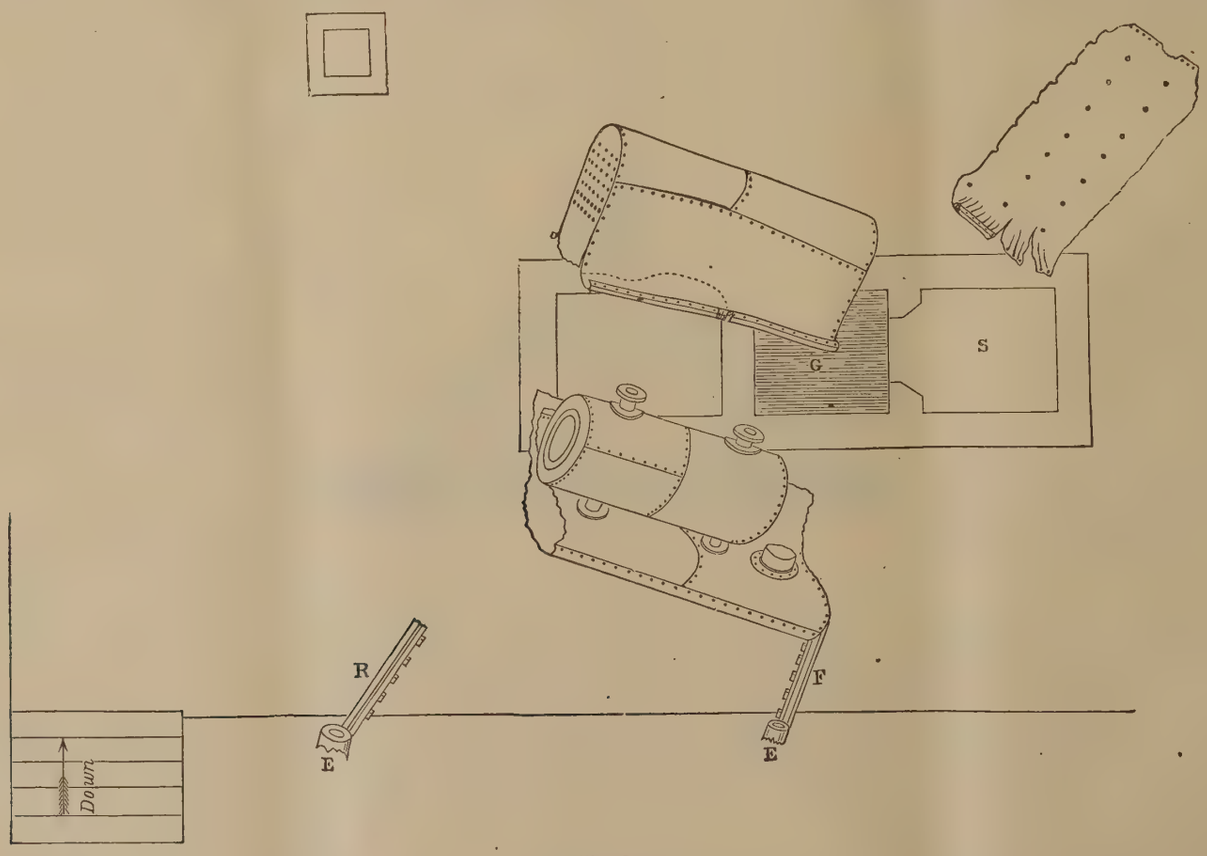


Fig. 9.

room where the boiler was, and could not have been frozen. Extensive repairs had been made from time to time and there were 7 patches and 8 new stays to be seen, as a part of such repairs, and another large patch was needed, and might have saved the boiler for the time being had it been applied on the day previous to the accident. As it was, there was evidence of a line of old corrosion and several leaks for a distance of about 3 feet on the outer shell, on the back

Figs. 7 and 8 are the full size section and plan of plate and stay bolt, also intended to explain the effect of the same action of the plates when they are laminated, and the commencement of "radiating" corrosion shown in the plan where one or more of the leaves are cracked, and showing in section the space around the stay which fills with oxid of iron; the motion soon wears away the threads, and tends to break off the heading of the stay, when finally it pulls through,

means easily exploded by friction or concussion, and the fact that, to effect its explosion in a blast hole, the strand match can be used. The powder is very light, and when in a loose state burns very slowly.

Iron or Wooden Ships—Which are Better?

We see it reported that the increase of iron ships in the English merchant navy during the last seventeen years has been very remarkable. In 1860, 181 iron vessels were built, a number which rose to 508 in 1864, when a check was experienced. But in the last two or three years it has passed the previous maximum, and last year 545 iron vessels were built. The increase in the size, however, is most remarkable, for while the number of vessels built has been multiplied threefold, the tonnage is six times as great. In 1860 the tonnage of iron vessels built was 64,699; in 1870 the 457 vessels built were 172,320 tonnage, and last year the tonnage of 545 vessels was 395,953; in the first half of the period 3,103 vessels were built, and in the second 4,254. But while the numerical increase in the second half over the first was about 37 per cent, the increase in the tonnage was 93 per cent. With the increase of the number of iron vessels afloat there is a large increase in the number of those annually lost. In 1860 there were only 7 iron vessels recorded as lost, and the tonnage of 1,288 assigned to them shows that they were comparatively insignificant in size. Until 1869 the number of iron vessels lost yearly was under 100, but in that year 104 were lost, and the tonnage of 53,483 shows that the average size was greatly increased. In 1874 the highest number recorded as lost was 159, the tonnage being 104,339. The figures that have been gathered for the present year prove that the iron vessels built and lost in 1878 will be found, both in numbers and tonnage, in excess of these for its predecessors. There are now indications that the use of iron in shipbuilding may be in some degree superseded by steel. At several shipbuilding centers vessels have been built of steel, which are now in service.

In seventeen years 7,367 iron vessels were built. If the proportion of loss given above holds good, 1,738 must have been lost during the period; this would be nearly one-fourth of all those built, which is not a very flattering exhibit.

On the foregoing facts a contemporary remarks: "Of old the wooden walls of England used to be her pride; they are not so to-day. Of all the English vessels afloat the largest number are undoubtedly of iron. There is a reason for this; the oak forests of Great Britain have been disappearing before the woodman's ax year by year, and now little can be had outside of the demesnes of the nobility, and what can be had is too dear to build ships with. Iron is and has been the cheaper material, and England had to use it or go out of the shipbuilding business. But for this substitution the forests of Maine and the Pacific coast would long since have taken the place of those of England, and civil war or no civil war most of the vessels would have been American, and built of wood—England's glory as a maritime power would, in a commercial sense, have passed away. It is, therefore, to the interest of English insurance companies to discriminate in favor of iron vessels, and of England's commercial magnates to spread this idea of superiority by all means in their power. Let this idea be uprooted, and England will have to give way to America on the sea, or to purchase her vessels ready built from the dockyards of Maine, or those which may be started on the Pacific coast. The substitution of steel for iron may delay the inevitable, but we doubt if it will long delay it."

Industrial Relations of Canada with England and the United States.

Our Northern neighbors are beginning to take a sensible view in regard to their own interests. While

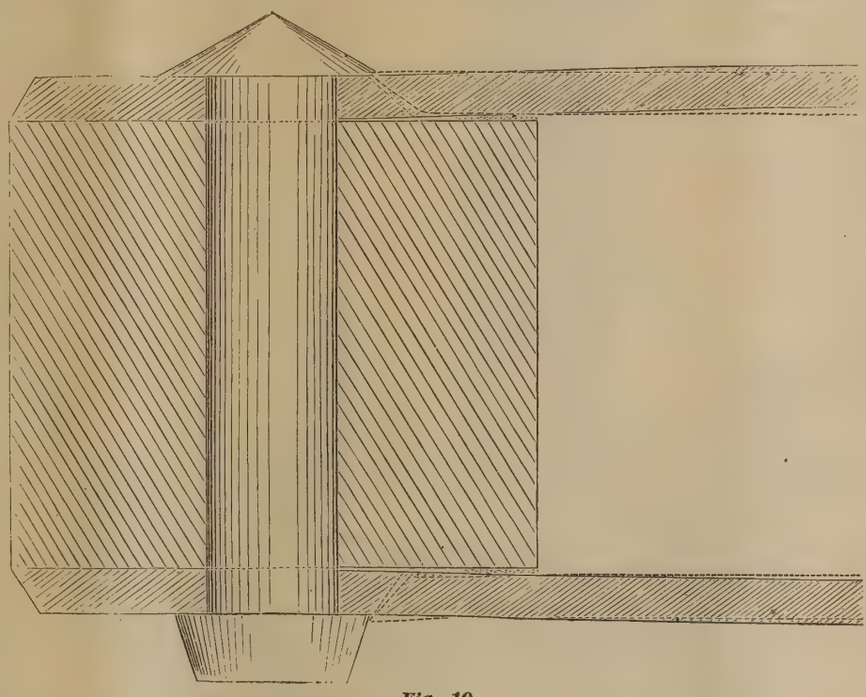


Fig. 10.

England's policy has always been to treat Canada as a colony, confining her industries to the production of the raw staples, and not to manufacturing enterprises, in order to extend the market for English goods, the Canadians commence to see that they can manufacture as well themselves, especially as the climate is not advantageous for agriculture, and competition with the more favorably situated United States is up-hill work.

Fig. 11.

For the purpose of advancing Canadian manufacturing interests they are now discussing a new policy, which will be very disadvantageous to England, and perhaps equally disadvantageous to some interests in the United States. For this reason we call the attention of our manufacturers to the advantages of inducing Congress to consider the necessity of some treaty which might be framed in such a way as to promote mutual interests. As it may be well to know exactly

Fig. 12.

the spirit prevailing in this respect in Canada, we copy from the *Mail*, a government organ published in Toronto, an editorial, which we commend to the serious consideration of our manufacturers:

"The policy submitted by the government is essentially a Canadian policy, framed with the deliberate intention of building up Canada, developing her resources, and protecting her nascent industries against undue outside competition; and if our British connection is endangered by it then so much the worse for the British connection. Nature never intended the inhabitants of the Dominion to remain for all time an agricultural people. The vast mineral wealth of the country, its unrivalled water power, the variety of its productions, its boundless area, and above all, the intelligence, energy and self-reliance of its people—all these bear witness that we have a mission far beyond the primitive calling of bartering wheat and cattle for the products of foreign looms or the output of foreign workshops. It cannot be the British policy that we should remain as we are. Manchester and Sheffield probably desire it; they have always looked upon colonists as white Hindoos, created to be consumers of their adulterated cotton and cheap cutlery, and no doubt our reform friends speak truly when they say the national policy will excite their displeasure. All we can say is let them be displeased; we are not a conquered people, on whom they can thrust their wares by force of bayonets; nor is the national spirit yet sunk so low that we dare not be loyal to Canada for fear of being charged with treason to British manufacturing interests. British connection imposes no such yoke upon us. British policy toward Canada is not regulated by cotton lords. It is not founded upon selfishness nor based upon cupidity; it is a bond mutually honorable and mutually advantageous, and whatever Manchester or Sheffield may say, the nobler instincts of the British people will approve our efforts to build up a great British nation here. We cannot believe that the new Canadian policy will provoke the mother country or endanger our relations with her; she would be false to herself, to her traditions, and to the spirit of freedom, of which she is an apostle, if she bade us submit ourselves to British manufacturers, abandon our native industries and relapse into a pastoral state. British connection on such terms might suit slaves, but no people of British origin would tolerate it.

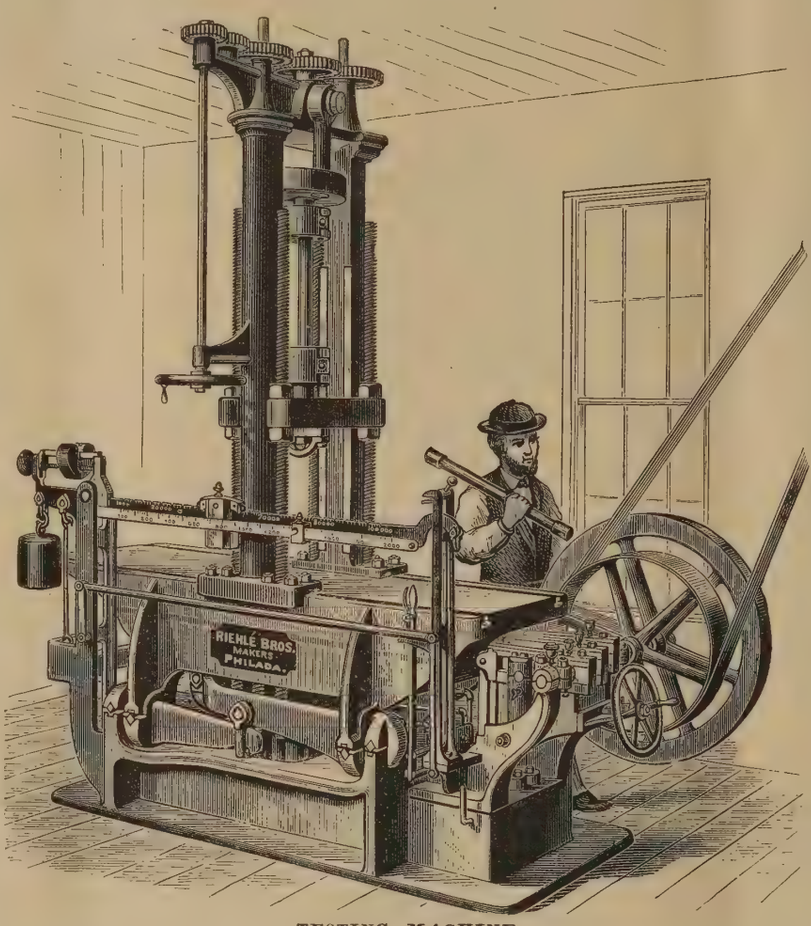
"The cry that the new policy will anger the Americans is equally unworthy. What have they done for us that we should consult their feelings in framing a fiscal policy for Canada? At a critical period in our history they abrogated reciprocal trade relations with the avowed object of starving us into annexation. For years they have met our conciliatory advances with hostile tariffs. Our markets have been wide open to them, but they have persistently kept their gates shut against us; they have rejected our advances and returned evil for good in every way; not even the appearance of a suppliant reciprocity commissioner at the door of Congress in 1874, moved them, although he offered them most extravagant terms if they would only consent to be neighborly. We have asked and entreated long enough; the time for action has come. If they are irritated by the new protective policy, we can point to the Morrill tariff; if they accuse us of being unneighborly, we can show them Mr. Brown's articles of reciprocity and the contemptuous refusals of Congress. We can point to their vexatious 'dickering' over the provisions of the Washington treaty; to the duty on lobster cans and cod liver oil, levied for the

express purpose of evading that treaty; to the manner in which they discharged their international obligations during the Fenian raids, and to their whole line of conduct toward us for the past thirteen years. We have an abundance of *tu quoque;* but, better than all such, we can make the dignified answer that the Canadian people have the right, and intend to exercise it, of shaping their fiscal policy as they deem best for their own interest, regardless of the views of a foreign country which has always declined to meet them half way in inter-trade negotiations."

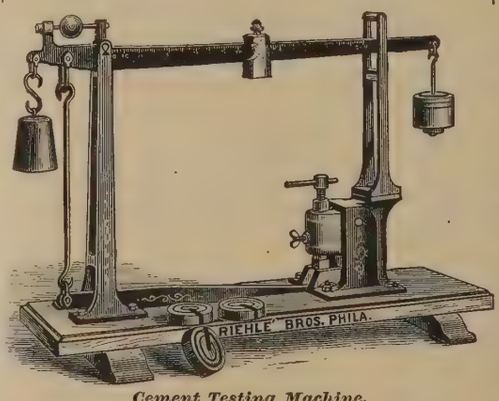
Testing Machines.

We take pleasure in illustrating the new 50-ton testing machine now in successful operation at the testing laboratory of the Pennsylvania Railroad Company, at Altoona, Pa., which was designed and built at the Scale Works of Riehlé Bros., Philadelphia, and patented February 11, 1879. This machine, although of such large capacity, is remarkably sensitive and accurate. In accordance with the specification of the Pennsylvania Railroad Company, it was subjected to a series of tests by experts of the company, and in every case, we are informed, it more than met their expectations. The weighing system was put to a test by an opposing leverage and standard weights up to nearly the capacity of the machine, and in each case it registered the weights without any variation whatever. In order to ascertain whether any of the parts were likely to be weak or become displaced when the machine was subjected to severe shocks, several pieces of steel were broken, requiring nearly the full capacity of the machine, (50 tons), and in each instance the machine remained intact, and registered perfectly correct notwithstanding the tremendous shocks, which were calculated to make a variation of the weights; but none occurred. This is remarkable, considering that it has no foundation, but stands complete in itself, without a bolt or anything to hold it in position, thus demonstrating how well it is adapted for heavy work, being very compact, all the bearings made of the best steel, perfectly true and even, and the workmanship good throughout. This machine is adapted for a wide range of experiments; it will take in specimens of the following sizes: Tensile strain, flat specimens, 3 × 1 inches, 4 feet long, and less; round, 2 inches in diameter and less, 4 feet long and less; square, 2 inches by 4 feet long, and smaller sizes. Transverse specimens, girders, 18 inches high by 12 inches wide, up to 5 feet long, and longer, by using an extra beam for support. Crushing specimens, 12 × 12 inches, 4 feet long, and smaller sizes.

The machine is capable of testing specimens by tensile, transverse, or crushing power, and contains every requisite that can be desired for accurate testing of material generally; even girders of any length can be tested by using an extra beam for support, as stated above. The weighing system is very compact, occupying the smallest possible space, and completely encompassing the jack beneath the table. The machine can be operated by hand or steam power, either being under instant and perfect control. The pump, which has three plungers, throws a steady, uniform stream, and possesses the peculiar and desirable feature of having its stroke made longer or shorter by simply turning a hand-wheel without stopping the power, thus enabling the operator to make the most delicate test, ascertaining the limit of elasticity, etc. It is also so constructed that, without stopping the pump in its motion, the flow of the fluid can be instantaneously cut off from the jack without relieving the already existing pressure in the same, by a slight motion of a lever under control of the operator, when using the weigh beams, a feature indispensable when pumps are operated by power. A lever convenient to the operator works the change valves of the pump, causing the plunger of the jack to move in either direction, as may be desired. For holding a strain on specimens for any length of time beyond that required for ordinary tests, two strong screws are, by proper arrangement, forced against the cross-head of the plunger by means of a hand-wheel, preventing any backward motion of the same, even should the pressure in the jack be lost by any leakage.



TESTING MACHINE.



Cement Testing Machine.

It is impossible to say how valuable an apparatus of this kind is to railroad companies, iron manufacturers, and others who deal largely in materials that ought to be of a specified strength, as the buyer is invariably at the mercy of the seller, unless he is provided with a reliable apparatus to test the material before purchasing. Not only in iron works and railroad companies are these machines required, but also by manufacturers of all kinds of material, such as cement, leather, paper, cloth, etc., for all of which this firm are manufacturing machines. We understand they are now negotiating with the officials of one of our cities to furnish one of these machines for testing all the materials—girders, stone, cement, etc.—that they buy for the erection of State buildings.

Our second figure represents a cheap, compact and accurate testing machine for ascertaining the strength of cement or other material by compression. The beam is of brass, with sliding poise, and graduated from 1 pound up to the capacity of 1,500 pounds. The levers being carefully sealed to the United States standard, the results of the tests are positively correct. The specimen (1 inch cube) is shown in position at the butt end of the main lever, just below the thumb screw. The following simple directions will show how to operate the machine: After the specimen is properly adjusted in place, force the screw down with the hand lever until you have got enough pressure on to make the lever nearly touch the top of the stand; the weight on the beam is then carefully increased and the specimen will, in most cases, break before the beam reaches the bottom of the stand or gate. If, however, it should not, the beam is again raised by applying pressure with the screw and moving the poise on the beam until the specimen breaks, or the desired test is applied.

New Method of Analyzing Ores.

Prof. George A. Koenig, of the University of Pennsylvania, has invented what he calls a "chromometer," which he uses for determining the presence of certain metals in ores. It is based upon the fact that complimentary colors will extinguish each other if mingled in proper proportions; for instance, if to a green solution a red solution be added, the liquid will obtain a neutral tint. He has applied this principle to the colors which certain metals, such as iron, manganese, copper, etc., produce when fused with borax. He prepares glass beads containing known quantities of a metal in 100 parts, and observes how thick a glass of the complimentary color must be to produce neutralization. For this purpose the instrument is furnished with a glass wedge of a green or red color, but at an angle of about one degree. By moving this wedge before the glass bead, a scale moves at the same time, and when the point of neutralization of color has been reached, the reading of the scale refers to a table showing the percentage of metal contained in the examined substance. Prof. Koenig claims that by this method a correct determination of manganese in iron ore can be made in one-third the time required by the usual methods of analysis.

PRODUCTIONS IN PAPER.—In addition to the articles enumerated on page 223 of our October number for 1878, as being exhibited at the late Berlin exhibition, the following were shown: Wash basins, water cans, carpeting, bonnets, a full rigged ship, lanterns, hats, masks, shirts, clothes—full suits, straps, handkerchiefs, napkins, bath tubs, buckets, bronzes, flowers, urns, window blinds, asphalt roofing, materials for garden walks, coral, jewelry, window-curtains, shirts, lace, belting, and a house made of pine, but with not only roof, ceiling, cornice and interior walls of paper, but all the furniture, blinds, curtains, chandeliers, carpeting, ornamented doors, numerous mantle and table ornaments, and finally a stove of asbestos paper burning away cheerfully, and not consuming itself, as it evidently ought to do.

The Law of Evaporation.

If a volatile liquid is in contact with the air, it diminishes in quantity, and after a shorter or longer time disappears entirely. The water which, after a rain-shower, covers the ground, often disappears very rapidly, not only penetrating the soil, but also evaporating in the air, especially when a dry wind blows and the sun shines. Evaporation becomes very rapid when water is heated to its boiling point, and it disappears in a very short time, while it changes its liquid condition into a gaseous one. Liquids changed by heat into gas are called vapors.

Fig. 1.

The error has prevailed for a long time that vapors cannot exist independently; it was believed that liquids were dissolved by the air, as salt is dissolved in water, and that in order to change a liquid into the gaseous state, it was only necessary to have the air as a solvent, which would absorb the vapor of liquids, in the same way as a sponge absorbs water. In order to upset this error, and at the same time to study the true law of evaporation, it is necessary to form vapors in a vacuum. Toricelli's vacuum—that is, the space above the mercurial column in a barometer—is especially adapted for this purpose, first, because it is a better vacuum than can be produced by an air pump, and, second, the depression of the mercurial column by the expansive force of the vapor offers a means of measuring this expansive force.

Suppose we have three barometer tubes, filled with mercury, inverted and with their open ends placed in the same vessel with mercury, (see *v*, Fig. 1); then if by means of a glass tube with a curved point, a few drops of water are brought under the tube *b'*, it will ascend through the mercurial column, and as soon as it reaches the vacuum at the top it will evaporate, the vapor will fill the open space over the mercury, and it will depress the mercurial column the fraction of an inch, more or less, according to the temperature. The vapor of this water acts in the same way as if a small quantity of air had been admitted. Suppose the mercury in the tube *b'* is found to stand at the hight of *t*, half an inch below *c*, the position of the mercury in the barometer tube *b*, in which there is a dry vacuum, it is evident that the vapor of the water possesses an expansive force of half an inch; the weight of a mercurial column half an inch high will then be the measure of the tension of the watery vapor at the temperature that the observation is made. If in another tube *b''*, instead of water, a more volatile liquid, such as ether, is introduced, a very strong depression of many inches will at once be observed. At the ordinary temperature of 60° to 70° the depression of the mercurial column will amount to about half the hight of the dry barometer *b*; it follows from this that the vapor of ether possesses, at the temperature mentioned, an expansive force of about half an atmosphere.

The tendency of vapors to expand, extends, like that of gases, to infinity—this means that the smallest quantity of vapor diffuses itself equally in any empty space, however large it may be, and this in all directions, so that it will exert more or less pressure upon the walls of the space it occupies. The smallest quantity of water, when in the state of vapor, is therefore capable of filling a space of several thousand feet, in the same way that air would fill it.

While vapors have an expansive force which extends to infinity, this force cannot by compression always be so far increased as is the case with gases. In these the pressure or expansive force increases for a very large range in the inverse ratio to the volume to which they are compressed; but if it is attempted to compress vapors, they resist only until very soon a point is reached when they return to the liquid state. The limit of this resistance, when no further compression can increase the resistance, is called the maximum tension of the vapor.

In order to demonstrate this characteristic difference between gases and vapors by experiment, the arrangement shown in Fig. 2 is used. A barometer tube is carefully filled with dry mercury, from which all air has been expelled by boiling; it is then placed in a wider tube of the same length, also filled with mercury, while the top is expanded into the cup *c n* to prevent the mercury from overflowing. A little ether is also placed over the mercury at *s*, which causes a considerable depression in the mercurial column. This column, when the hight of the mercury, before the introduction of the ether, was 30 inches, will be reduced to say 16 inches; it follows that the tension of the vapor of ether is equal to a mercurial column of 14 inches. If now the barometer tube is sunk into the lower tube, it will be found that the hight of the mercurial column remains exactly the same, notwithstanding the space filled with the ether vapor is made much smaller; all the difference seen is that the amount of liquid ether over the mercury increases, while, when the tube is depressed until the closed top has reached the hight of 14 inches over the surface of the mercury in the cup *c n*, all the vapor will be liquified, and no apparently empty space be shown; when, raising the tube again, the ether will re-fill the space with its vapor, and when its quantity is small enough it may repeatedly be shown how it may be made to change into invisible vapor, or by raising the tube, apparently disappear, and reappear by depressing the same. When there is air in the tube instead of liquid ether and its vapor, it will behave quite differently, but nearly in the same way that ether behaves when its quantity is so small that the tube may be moved to some distance without

Fig. 2.

liquefying a part of it. It will thus be seen that vapors, when not in contact with the liquid from which they are generated, behave according to the law that the tension is inversionally proportional to the volume.

We have already stated that the tension varies with the temperature; thus at 32° Fah. ether depresses the mercurial column only 9 inches, while at 86° Fah. it amounts to 25 inches. It may therefore be asked what the tension will be in a space filled with vapor when unequally heated. At the coolest places the vapor will be reduced to the liquid state and a corresponding tension obtained, while according to the nature of equilibrium in gases and vapors, the tension must be equal all through the space. It thus follows that in the whole space the tension of the vapor must be equal to that which it possesses at the coolest places, and that therefore at the warmest places the vapor can never possess the tension which belongs to it according to its temperature. This is a very important point, often lost sight of when discussing the action of various steam boilers and their connections.

Fig. 3.

The principle is easily demonstrated by the apparatus represented in Fig. 3. The ball *a* is half filled with ether, which is boiled so as to drive out all air through the open lower end *e*; while the ether vapor is escaping this end is plunged into a little cup containing mercury. While the ether is cooling the mercury ascends in the tube *b*, until the ball has reached the temperature of the surrounding air; then the rise of the column stops. If now only a part of the ball is cooled with a piece of ice, the mercury will again ascend, and behave in the same way as if the whole apparatus were placed in an ice-cold atmosphere.

A Warning to Petroleum Distillers.

It appears that lately our petroleum refiners have become careless in regard to the quality of the kerosene prepared for exportation, as complaints have been made in different localities that the oil has a less specific gravity, and is more liable to explosion than the former qualities thus far exported.

Any one acquainted with the method of refining oil, will see at once where the trouble lies; it is simply that our distillers have become neglectful in keeping the first product of the distillation, which is gasolin, and the subsequent product, which is benzin, separate, and running them into different tanks, then collecting the product of the distillation into the kerosene tanks when its specific gravity and volatility at about 100° does not justify it. The result is that the kerosene thus obtained contains benzin, which, at 100°, gives off a combustible vapor; in this way all the oil is condemned, while in fact the objectionable volatile benzin may constitute a comparatively small percentage.

The reason why some distillers have fallen into this habit, is that some natural oils are very light and contain much benzin, therefore in order to obtain the customary quantity of kerosene, (which is the most valuable ingredient, and for which there is an unlimited demand, while benzin is a drug in the market), distillers cut off the benzin stream too soon, and run doubtful oil into the kerosene tanks. We trust that the complaints will be heeded in time, as otherwise our refiners will lose their important European custom. Belgium already talks of prohibiting the importation of American refined petroleum, while in Bremen an assembly of delegates from various parts of Europe, who will discuss various measures, is also to take steps to stop the trade in dangerous qualities of petroleum.

Distillers will see that oil, such as they do not dare to sell here, for fear that it will not stand the fire-test, cannot be sent abroad with impunity.

Lighting Railroad Cars by Clockwork. — A novel idea in car lighting has been introduced in some cars on the Fort Wayne (Ind.) accommodation trains. By day passengers note a richly ornate lamp with neither

globe nor chimney, and not even an escape through the chimney for smoke. The mystery is explained when the brakeman takes a key from his pocket and proceeds to wind up each lamp as if it were a music box. This clockwork is located in the base of the lamp and sets in motion a small propeller-shaped fan, which forces air up to the burner above.

This idea is very old, but its application to car-lighting certainly is not. The result of the current of air acting upon the light is to broaden and intensify the light, and completely consume the smoke, as well as to create a splendid white flame which is as steady as that of any argand lamp, and not easily blown out. The silvered reflector above does not shown a particle of soot or smoke, and these cars are very popular with those who find it possible to read their newspaper as readily as by daylight.

Scientific.

Darwinism and Atheism.—We are indebted to our contemporary, the *Scientific News*, for a short-hand report of a lecture given by the editor of this journal on "Darwinism." We give the report here, with a few additions:

"At a recent meeting of the Polytechnic savants, the subject of the evening was an elaborate defence of Darwinism by Dr. Van der Weyde. The subject was illustrated by a long row of life-size pictures of monkey and human heads hung upon the wall, the heads representing the types of the various grades of development, ranged in regular order from the lowest type of monkey to the highest of man. This curious string of portraits consisted of drawings with charcoal, "fixed" by applying shellac dissolved in alcohol, by what is called the atomizing process.

"Dr. Van der Weyde defended Darwinism from the imputation that it leads to infidelity and atheism. The Darwinian theory touches only the manner of creation, and does not dispute creation itself; it teaches that new species may have been evolved from existing species, and that this is more probable than the hypothesis that each species of plant and animal has been created out of nothing; it teaches the existence of a law of evolution, as a substitute for an endless number of miraculous creations; it teaches that the origin of new species may have proceeded after a similar law to that which prevails in the origin of new generations—namely, by propagation. To be sure the mystery of propagation of the same species, in plants as well as in animals, notwithstanding we know its existence to be an established daily fact, is by no means perfectly understood, but we know that we have a new generation of men every thirty years. Now the Darwinian theory simply supposes that instead of the first individual of every species being created directly out of nothing, it evolved from some preceding species, and that its existence was the result of a law which is known as the law of evolution or development. Darwinism does not teach that man came from a monkey, but merely that man and monkey may had a common origin from an ancestry belonging to a race which has become extinct, and it only suggests the *possibility* that the highest type of monkey may have become developed into human form. The missing link—a man with a tail—which used to be an argument among anti-Darwinians, is unnecessary, as in the gorilla we have a tailless monkey.

"That nature does not proceed by leaps, but by slow, gradual development from one form to another, (for which the term 'evolution' has been adopted), is proved by the experience of every observing mind. The law of evolution applies as well to mental as to material progress; evolution is seen on every hand. Among the sciences geology is an evolution from mineralogy, palæontology an evolution from geology. Palæontology, which treats of the remains of animal and vegetable life found in the earth's strata, is not more than fifty years old; geology about one hundred years. The doctor expatiated on the subject-matter of these sciences to show how evolution took place. Then he went to the animal kingdom, showing gradual developments in which slowness was conspicuous; animals of the lion kind walk on five fingers; the horse tribe walk on one finger, and even the bat tribe also shows its five fingers in the wing. In many animals some fingers or toes are wanting, nevertheless the existence of those parts in a rudimentary state is demonstrated. From an observation of many such facts a suspicion at length grew that one kind of animal might possibly have grown from another kind, and this is all that Darwinism is. He maintained that Darwinism was a perfectly legitimate and orthodox idea.

"Reference was then made to the pictures on the wall, commenting on their various peculiarities. The first in the class of monkeys was the earliest distinguished by a placenta, being removed in that respect above the marsupials, as the kangaroo, etc.; the second was like a pig; the third like a dog; the fourth had a more intellectual expression than any of the preceding; the fifth, when one looked at it, might remind him of some person he knew; the gibbon looked a highly intellectual creature; the young ourang (No. 7) might be taken for a young lady of sixteen, while No. 8 might pass for her mother. Between the highest and lowest monkey there was a greater difference than between the highest monkey and the lowest man. On the subject of embryology, he pointed out from the diagrams on the wall, how much the embryos of the turtle, the chicken, the dog, and man were alike in the first stage of their existence—so much so that they could not be distinguished one from the other, a fact even acknowledged by the greatest opponent of Darwinism, Louis Agassiz, who defended the idea of separate creations, even of the first specimens of every human race, contending that the negroes had their own Adam, who was black, while the Adam of the white man was as white as we are. In this aspect the Darwinians are more orthodox than Agassiz, as they maintain the unity in origin of all the human race, which Agassiz denies, the statement of the Scriptures notwithstanding. The doctor further pointed out how in a few weeks there began to develop a shell on the back of the young turtle. In the dog in embryo the development of the brain became somewhat marked, and the tail became longer. But in the embryo of man there was the greatest change, but with this difference between it and that of the dog—that in the human embryo the tail developed by growing shorter.

"This was the first intimation most of those present had that man, at any stage of his growth, had a tail, and the surprise was very general; yet a look at the picture of the human embryo revealed an unmistakable caudal appendage. Is it possible that the accounts of men with tails may after all not be fabulous?

"Soundings in the Pacific Ocean, continued the professor, made for the purpose of laying an electric cable from this country to China, have shown that the bed of the Pacific consists of hills and valleys like the present dry land. There is little doubt that the bed of the Pacific was once above water, and was inhabited by men. When these inhabitants found the continents slowly sinking, they withdrew gradually to the parts that remained dry. Some betook themselves to the tops of the highest mountains which the water did not reach, and which are the origin of what are now called the Polynesian Islands. There the retreating tribes became isolated; but the largest number remained together, and finally found themselves occupying the dry continent of Asia, where, by the mutual struggle for existence and the law of the survival of the fittest, civilization advanced most. The isolated races are found to be backward in civilization by reason of the want of the struggle for existence, whereby the inferior are naturally forced by their superiors from the more favorable situations. This is an illustration of the Darwinian principle of the survival of the fittest. The Australians are to be found nowhere but on the Australian continent; they are a savage race, and, like our Indians, are being slowly exterminated. Did the American Indians go from the Sandwich Islands to Mexico, or from the South Polynesian Islands to South America? Some have held that they started from South America to the islands, and that the tide of emigration was westward. Time alone will solve this problem. There can be no doubt that the antiquity of the human race reaches as much as 200,000 years at least. In regard to the counter statement that we are only 6,000 years old, science does not make it a point to combat that, but merely to discover truth wherever it is to be found.

"Dr. Van der Weyde's address was received with the liveliest interest, and often with applause."

A Contribution to the History of the Electric Light.—On pages 60 and 61 of our March number we gave an illustrated description of a few devices invented by the editor of this journal, for the purpose of utilizing steam or other power for the generation of electricity by the intervention of magnets and isolated coils, and the further application of the currents thus generated for electro-plating, electric light, ignition of explosives, etc. In this article we will give a historical review of the application of such currents for electric illumination, from which it will be seen that this application is by no means so new as is generally supposed to be the case.

The electric light produced by galvanic batteries was already used about three-quarters of a century ago; Sir Humphry Davy, with the large battery in the Royal Institute in London, produced as strong a light of this kind as has ever been exhibited since, and it was only the expense and trouble in preparing the large batteries, and keeping them in working order, that prevented its use; only on exceptional and special occasions were such lights used, and then more as an exhibition of the power of electricity than for any practical purpose. Neither is the subdivision of the light anything new, and if it has been claimed by some friends of Mr. Farmer that he subdivided and exhibited such a light forty years ago in Boston, Mr. Farmer himself will not pretend that he did anything new, but only repeated experiments performed some thirty years before that time by Humphry Davy and others in England, France and Germany.

In 1839 Faraday made experiments for the Trinity House at the Orford Low light-house with the Bude light, which consisted in the passage of an electric current, produced by a voltaic battery, through a small descending jet of mercury, enclosed in a glass vessel; the mercury became white-hot and evaporated under the evolution of a most intense white light. The experiments, however, were only partly successful, as the light was unreliable and its production very expensive and laborious. In 1862 a hydro-oxygen lime light was tried at the South Foreland light-house; but neither did this answer the purpose, which was to furnish a steady, reliable illumination from sunset to sunrise, night after night, and so none of these arrangements were adopted.

In the meantime it was becoming evident to many thinkers that as steam is the cheapest agent we have for producing power, it was an absurdity to attempt the production of power by means of a much more expensive method, such as electric currents obtained from voltaic batteries, and that therefore all inventors, and would-be inventors, of electro-magnetic motors, and improvements on them, were working in the wrong direction. It became more and more evident that if electric currents and power were transmutable, one into the other, it would be more econominal to transform power, cheaply obtained by steam or water, into electric currents than to do the reverse, and transform the electric currents obtained from expensive voltaic batteries into power, as electric batteries can never compete with steam or water power in regard to cost. In fact the conviction dawned upon the minds of all who looked into the subject with a clear eye, that the cheapest way to obtain a powerful electric current was the apparently roundabout way of burning coal in a furnace, make the heat evolve steam, use the steam to

drive a steam engine, make the steam engine drive a magneto-electric machine, and thus obtain the electric current developed by the revolution of its coils.

The first practical application of this idea was attempted in 1857, when experiments were made at Blackwell, with an electric light produced by the second improved machine made by Holmes, to which a Duboscq lamp was attached, originally intended to produce light by means of a voltaic battery of some 100 or more cups. These experiments, showing that the most reliable and cheapest light could be produced at the least cost by the application of steam power, were so far successful that on the 8th of December, 1858, the first electric light was practically shown on the sea for the first time by illuminating the South Foreland light-house.

The conclusion was very natural that such a machine, placed on board a steamship, could be worked by some surplus power of the engine, and, spreading a powerful illumination all around, would prevent collisions at sea. With this purpose, in 1856, such a machine was sent from England to New York city, and placed on exhibition in Canal street, near Broadway. The editor of this journal inspected it at that time in company with Mr. Collins, the owner of the American steamship line, (which ceased to exist soon afterward), but the light exhibited was deficient and unreliable, partly on account of the faulty construction of the machine and partly from the ignorance of those in charge. Mr. Collins was urged to buy the machine for one of his steamships, but of course did not do it. The same machine was afterward on exhibition in the Crystal Palace, but its deficiency was made glaringly apparent by Mr. Vergnes, who had an electro-magnetic motor on exhibition, driven by a large voltaic battery; when the English machine showed its light, Mr. Vergnes connected his battery to a Duboscq lamp, and his old-fashioned electric light totally eclipsed the light produced by the English magneto-electric machine. Its use as a light producer was abandoned, but finding that it would electro-plate, a stock company was formed to electro-plate with the same. Such and similar stocks were readily sold at that time; a showy electro-plating establishment was erected in Mercer street, but there were no dividends, the value of the stock gradually fell to $0, and the affair collapsed.

This is only one specimen of scores of similar enterprises we have witnessed, (the Keely motor, by the way, being one of the most recent).

On the 1st of February, 1862, the Trinity House exhibited the electric light permanently at Dungeness light-house, with Holmes' magneto-electric machine and lamp. The intensity of the electric luminary was about 12½ times that of the oil luminary; the cost per unit of light per hour was, for the oil, 0.1165*d.*, and for the electric light, 0.1294*d.* Frequent falling off of the latter light occurred, and the oil light had occasionally to be substituted. Shortly afterward the French light-house authorities established the electric light at Cape la Hêve, with the magneto-electric machines of the Alliance Company of Paris. In 1865 the same company sent one of their machines to New York, where the Duboscq lamp was placed in the light-house at that time existing at the southern point of the Battery, but since removed as useless.

The magneto-electric machine stood on the pier below, next to the steam engine driving it, while the electric current evolved was conducted by two stout copper wires upward along the outside of the building to the cupola, from which the oil lamp had been removed and replaced by a Duboscq lamp, which ought to have been placed so that its light would have been at the same hight where that of the oil lamp was—namely, in that focus of the surrounding revolving lenses which corresponds with the rays coming from the surface of the water in the bay, so as to throw the light on this surface; however, from ignorance, carelessness, or intentional neglect of the person in charge, the light was placed altogether too low, so that the surrounding set of revolving lenses threw the concentrated beams of light into the sky instead of on the surface of the water. This we noticed while ascending into the cupola during the night when the light was on exhibition. The result was, as might have been expected, that navigators declared the light insufficient—no better, or perhaps inferior to the oil lamp, while the fact was that the strong beam of light passed over their heads, as could best be seen while ascending the tower at a time when the air was slightly foggy; then the beams of light could be seen shining all around, not slightly downward, but slightly upward, in a direction several degrees above the horizon, while they should have been directed on the horizon and slightly below, as this light was intended to guide vessels at a short distance only. The result was a retardation in the acceptance of the electric light for light-house purposes in this country.

Making Silver.—The old delusion, or deception, that gold and silver can be made by compounding other substances, has, according to reports in the newspapers, lately been revived among us—this time by a certain Dr. Thomas Farriss, of Mount Pleasant, who, it is alleged, while at college discovered in the laboratory that the waste washings had accidentally precipitated a metallic substance on the bottom, which he found to be silver, and after trying for several years to reproduce the same substance, he at last succeeded, and now manufactures silver on a small scale for the benefit of those who supply him with funds. The materials used are as yet a secret, and will certainly remain so. The men he employs are said to be entirely ignorant of chemistry, and notwithstanding this they succeed very well in manipulating after his instructions. This is said to impress the ignorant very favorably; but upon those not ignorant it makes a very unfavorable impression. If his assistants were experts, the inventor would not be able to use, without detection, such substances as lunar caustic, or the so-called horn-silver, (which is a powder white as chalk), or any other compound, from which it is very easy to make silver.

We are convinced it is the old, old story over again.

Testing Oil by Electricity.—Among the many uses to which electricity is now put, may be mentioned the testing of oils. Professor Palmieri, of Naples, well known for his observations in connection with the eruptions of mount Vesuvius, has discovered that the resistance which oils offer to the passage of electricity is in proportion to their purity. The professor has constructed an apparatus which shows, by comparison with pure olive oil as a standard, to what extent oil is adulterated, for the former is the worst conductor of electricity, while adulterated oils have a greater conductivity. The apparatus also indicates other mixtures, as, for instance, an even insignificant addition of cotton in a silk tissue.

A Hint to Teachers in Chemistry.—As a lecture experiment, Dr. Erckmann introduces a piece of potassium about the size of a pea into a small test tube, heats to fusion, turns the glass round and round until the metal congeals, and then seals up the tube. The greater part of the potassium is deposited on the sides of the tube as a specular metallic coating, resembling silver, and can be exhibited during lectures, etc. The other alkaline metals may be similarly treated.

Making Extracts.

Two different operations are performed in the process of making extracts; the first relates to the production of a solution of the soluble portion of the substance operated on; and next, the reduction of this solution to a proper consistency by evaporation. The substance is first, where practicable, reduced to coarse powder by bruising, or sliced with a knife, so that every portion may be fully exposed to the action of the solvent. Refractory substances are first softened by the solvent and then sliced. Other substances whose nature does not require reducing, are used without preparation

Different fluids are used for solvents, as best adapted to the solubility of the substance under treatment. Some bodies, such as fresh vegetables, yield their juice by expression alone. In the preparation of *aqueous* extracts, the ingredients are treated with rain or distilled water, until all the soluble matter that it is desired to obtain from them is dissolved. This is effected by either *maceration*, *percolation*, *infusion*, or *decoction*, as circumstances require; the solution thus obtained is poured off and the remaining soluble matter either pressed or washed out, and added to the solution; it is next allowed time to settle, then decanted, and strained or filtered; and if this fails to render the liquid clear, it is clarified by the white of egg, filtered; Canton flannel, first soaked in water, being generally employed for this purpose. When water acidulated with acetic acid is employed, vegetable substances are usually macerated in it in the cold, or the dilute acid is sprinkled over the bruised plant, if fresh, and the juice expressed by strong pressure.

When the principles to be extracted are insoluble, or only slightly soluble, in water, alcohol is employed, either in the form of rectified spirit, or diluted. These produce *alcoholic* or *spirituous* extracts; and are generally obtained by either *maceration* or *digestion*.

Ether is well adapted for obtaining extracts from bodies whose principles consist of volatile oils or resin, on account of its strong affinity for these substances. Such are termed *ethereal* extracts. In nearly all cases, filtration is necessary to insure a pure extract.

The means usually employed for evaporating an *aqueous* solution, are rapid boiling over a fire until the extract is thick enough to offer some risk of burning, and the evaporation over a water bath or in shallow vessels at a moderate heat, the further escape of vapor being promoted by continuous stirring with a wooden spoon or stick. It is not always advisable to heat a solution to the boiling point, but if boiling is resorted to, it cannot be done too rapidly, as the heat cannot rise above its boiling point, and rapid ebullition hastens evaporation. The fluid must never be stirred while ebullition is going on.

Two fundamental rules are, to conduct evaporation at as low temperature as is consistent with other objects, and to exclude atmospheric air, or, at least, to expose the liquid to its action for as short a time as possible, most solutions losing more or less of their active principle by heat and exposure. Solutions which will not bear boiling without loss of strength are evaporated in a vacuum, either in a closed still, or under the receiver of an air pump, in which a vessel is placed containing strong sulphuric acid; this has a powerful affinity for water and absorbs its vapor as quickly as it comes in contact with it.

A good plan for evaporation, though slow, is to place the liquid in a broad shallow vessel, exposed in a stove or drying room to a temperature of about 100° Fahr., allowing free access for the air. The extracts thus evaporated are said to be lighter in color and more transparent than by most other ways.

The method for evaporating an *alcoholic* or *ethereal* solution is substantially the same as that pursued with an aqueous solution; except that, as a matter of economy, the vapor may be led off and condensed again.

A good extract should be free from grit, and wholly soluble in 20 parts of the solvent used for making the extracts, forming a nearly clear solution; it should be of a proper consistency and of uniform texture and color, smooth and glossy in appearance; this latter can only be arrived at by assiduous and laborious stirring as the extract thickens; and may be promoted by adding 3 or 4 per cent each of olive oil and gum arabic, with 1 or 2 per cent of spirit of wine. Extracts should be put in pots as soon as made, securely tied down with bladder, and kept in a dry place. Any tendency to become moldy may be prevented by adding, the last thing before removing from the evaporating pan, a few drops of oil of cloves, or a still less quanity of creosote, dissolved in a little alcohol; or by moistening with oil of cloves or creosote, the inside of the bladder used for covering the pots.

Culverts vs. Bridges.

On page 77 of our last number we explained in what cases culverts had a decided advantage over bridges, especially when inventions are applied, such as that of Mr. John C. Goodridge, Jr., President of the New York Stone Contracting Co., of Brooklyn, N. Y., to line the interior of the culvert, whether new or old, over its whole length, with beton.

Last month we represented one end of the culvert under the high embankment of the Erie railroad near Warsaw, N. Y.; the present engraving shows the other end, with the machine for mixing the beton. We wish we could add the words, "In operation, with the men at work." The fact is, everything is represented at a stand still, as is usually the case when a photographic picture is taken. Had an artist painted the scene, he would have had common sense enough to represent the men at work, but here they are all idle, looking at the spectator; this is a proof that the picture has been taken by photography, and is a truthful representation of the locality of the tunnel, but not of the way the workmen made it, because photographers do not as yet appear to have realized the absurdity, when they take a view, of allowing each man to stand on exhibition and stare at the camera, so as to have his individual portrait well shown on the photograph. The result is an inartistic picture; but in this case it is of no importance, as the tunnel and its surroundings, showing the high embankment under which it is situated, are the points to which we wish to call the attention of our readers, and also to the convenience of mixing the beton by steam power above the entrance, and letting it down by a chute, to be transported to the interior by wheelbarrows, into a small tunnel like this, or on a temporary railroad track when the tunnel is large, so as to admit a number of men to work at it at the same time.

We should like to see this system of lining a tunnel applied to the proposed tunnel soon to be driven under the Hudson river from Jersey City to New York. Blocks of the proper size might be made outside, and when hard be transported to the interior, and applied in combination with brick and beton. We make the suggestion to those interested.

REPAIRING A CULVERT WITH BETON ON THE ERIE RAILROAD.

Dangerous Contrivance to Eliminate Sewer Gas.

We see in the daily papers that the important sanitary problem of disposing of sewer gas—which frequently invades private residences and public buildings to such an extent as to endanger the lives or health of the inmates—has been solved by a Philadelphia inventor named A. W. Rand, and that the simple and effective apparatus invented by him for the purpose is on exhibition. It is described as follows: "A small pipe leads from the outer air to the sewer pipe, at its highest point in the building. Another pipe connects with the sewer pipe at its lowest point in the building, and leads therefrom to a small air-tight chamber, which takes the place of a portion of the ordinary lining in the house range or furnace. The gas comes up into this chamber, and is there entirely freed from noxious elements, and, being heated, passes upward, through another pipe, into the chimney. A constant current of air is thus created, beginning at the pipe leading into the outer atmosphere, passing down entirely through the sewer pipe of the house, then upward into the hot air chamber above mentioned, where the gas, which is carried along with it, is entirely consumed. The current which sets in at the pipe leading from the outer air to the sewer pipe, is so strong that while a gentleman was testing it with a piece of lighted paper, the paper was drawn out of his hand and down the pipe.

"The apparatus has been tested by a number of scientific men, architects and builders, all of whom have become quite enthusiastic over it. A great point in its favor is its simplicity and comparative inexpensiveness, since a house of the costliest character, it is claimed, can be fitted up with it at an expense of not more than fifty or sixty dollars. That sewer gas will be robbed of its terrors by means of this apparatus is beyond a doubt. The temperature in the air chambers will rarely be less than 400°, and it has been demonstrated that the vitality of vaccine matter is destroyed at a temperature of 140° Fah., the virus of scarlet fever at 204°, and the lower orders of vitality will probably be destroyed at 212°, or perhaps a little higher rise of temperature."

So much for the report. We think it our duty to point out the danger of leading sewer gas into the chimney, as here proposed. When fires are burning and the chimney drawing well, it is all right, but when, during the summer, fires are not used, or the house itself is perhaps unoccupied for some weeks, then in such a case the chimney, and the air in the same, may be cooler than the surrounding summer atmosphere, and instead of an upward draft, a downward draft will be established, and the sewer gas discharged into the house; when this continues for days, or perhaps weeks, it will have been transformed into a real pest hole, unfit to live in. The ceilings, wall paper, carpets, furniture, etc., will be penetrated with the sewer gas, and the most thorough fumigation with disinfectants would scarcely suffice to render it inhabitable again.

A Method for Mending Broken Castings.—Mr. C. de Laharpe gives a method for mending broken castings, which may, in many cases, prove valuable in an emergency. It consists in heating the two pieces together by a stream of molten cast-iron until the parts near the line of breakage commence to melt. At exactly that point the flow of cast-iron is stopped, and a small quantity of metal is left behind, which, in chilling, unites the two parts. If the operation is well conducted, the piece thus mended will break more readily at any other part than the new seam. It is necessary, in order to be successful, to induce melting of the broken edges over their whole length, and therefore the thickness of the casting must not be too small in comparison to its length, nor should there be, in the direct vicinity of the fracture, any marked irregularities of thickness. The broken part must also be perfectly independent of the rest, or else the expansion and contraction will cause breakage. The Chinese have used this method of mending broken cast-iron vessels from time immemorial.

Latest Market Report of Building Materials.

NEW YORK PRICES.

ARTICLES MARKED WITH A STAR (*) ARE QUOTED IN GOLD.

—o—

LUMBER.

Pine, very choice and extra dry, per M	$55 00 *a* 60 00
Pine, good	45 00 *a* 50 00
Pine, shipping box	18 00 *a* 22 00
Pine, common box	14 00 *a* 16 00
Pine, common box, ⅝	13 00 *a* 15 00
Pine, tally plank, 1¼, 10 inch, dressed, each	40 *a* 43
Pine, tally plank, 1¼, 2d quality	35 *a* 38
Pine, tally plank, 1¼, culls	25 *a* 28
Pine, tally boards, dressed, good	28 *a* 30
Pine, tally boards, dressed, common	22 *a* 25
Pine, tally boards, culls, dressed	21 *a* 23
Pine, strip boards, merchantable	16 *a* 18
Pine, strip boards, clear	22 *a* 25
Pine, strip plank, dressed, clear	33 *a* 35
Spruce boards, dressed	18 *a* 20
Spruce plank, 1¼-inch, dressed	22 *a* 25
Spruce plank, 2-inch,	28 *a* 34
Spruce wall strips	13 *a* — 15
Spruce timber, per M	16 00 *a* 19 00
Hemlock boards, each	14 *a* — 16
Hemlock joist, 2½x4	15 *a* — 16
Hemlock joist, 3x4	16 *a* — 18
Hemlock joist, 4x6	40 *a* — 44
Ash, good, per M	30 00 *a* 50 00
Oak	32 50 *a* 65 00
Maple culls	20 00 *a* 25 00
Maple good	45 00 *a* 85 50
Chestnut	42 00 *a* 48 00
Cypress, 1, 1½, 2, and 2½-inch	35 00 *a* 40 00
Black walnut, good to choice	85 00 *a* 100 00
Black walnut, ⅝-inch	75 00 *a* 85 00
Black walnut, selected and seasoned	110 00 *a* 150 00
Black walnut counters, per ft	12½ *a* 20
Cherry, wide, per M	85 00 *a* 100 00
Cherry, ordinary	60 00 *a* 80 00
White wood, chair plank	60 00 *a* 70 00
White wood, inch	25 00 *a* 45 00
White wood, ⅝-inch	30 00 *a* 45 00
White wood, ⅝ panels	35 00 *a* 50 00
Shingles, extra shaved pine, 18-inch	9 50 *a* 10 00
Shingles, extra shaved pine, 16-inch	8 50 *a* 9 50
Shingles, extra sawed pine, 18-inch	7 00 *a* 8 00
Shingles, clear sawed pine, 18-inch	6 50 *a* 7 50
Shingles, cypress, 24x7	20 00 *a* 22 00
Shingles, cypress, 20x6	12 00 *a* 15 00
Lath, Cargo rate	— — *a* 1 55
Yellow dressed pine flooring	25 00 *a* 35 00
Yellow pine girders	30 00 *a* 40 00
Locust posts, 8 feet, per inch	18 *a* 20
Locust posts, 10 feet	24 *a* 25
Locust posts, 12 feet	29 *a* 34
Chestnut posts, per ft	3 *a* 3½
Basswood per M	25 00 *a* 30 00

BRICKS.

Nominally.	Cargo.	Afloat.
Pale, per M.	2 25 *a*	3 00
Up River	4 50 *a*	5 00
Staten Island	5 37½ *a*	5 50
Haverstraw Bay	5 12½ *a*	5 25
" " choice	5 37½ *a*	5 50
Favorite Brands	6 00 *a*	— —

FRONTS.

Croton—Brown, per M.	7 00 *a* 8 00
" Dark	8 00 *a* 9 00
" Red	9 00 *a* 9 50
Philadelphia	26 00 *a* 28 00
Trenton	24 00 *a* 29 00
Baltimore	34 00 *a* 38 00

Yard prices 50 cents per M higher, or with delivery added $2 per M for hard and $3 per M for front brick. For delivery add $5 on Philadelphia and Trenton, and $6 on Baltimore brick.

IRON—PER TON.

Duty.—Bar, 1 to 1½c. per lb.; Railroad, 70c. per 100 lbs.; Boiler and Plate, 1½c. per lb.; Sheet, Band, Hoop and Scroll, 1¼ to 1¾c. per lb.; Pig, $7 per ton; Polished Sheet, 3c. per lb.; Galvanized, 2½c. per lb.; Scrap Cast, $6 per ton; Scrap Wrought, $8 per ton—all less 10 per cent. No Bar Iron to pay a less duty than 35 per cent ad val.

Pig, Scotch—Coltness	21 50 *a* 22 50
" Glengarnock	20 50 *a* 21 50
" Eglinton	19 50 *a* 20 50
" American, No. 1	17 50 *a* 19 00
" American, No. 2	16 50 *a* 17 50
" American, forge	15 50 *a* 16 00

	Store prices.	Cash.
Bar, Swedes, ordinary sizes	— 5 *a*	— 6
Ba., Swedes, nail-rod	— — *a*	— 6½

LEAD—PER 100 POUNDS.

*German	— — *a* — —
*English, common	— — *a* — —
*Spanish	— — *a* — —
*Foreign, refined	— — *a* — —
*Bar	5 00 *a* — —
*Sheet and Pipe	5 00 *a* 6 00
*Domestic	3 37 *a* — —

NAILS—PER KEG.

10d to 60d, common, fence and sheathing	2 30 *a* — —
8d and 9d, common	2 85 *a* — —
6d and 7d, common	3 10 *a* — —
4d and 5d, common	3 35 *a* — —
3d and 4d, light	4 10 *a* — —
3d, fine	4 85 *a* — —
2d, fine	4 85 *a* — —
Cut spikes, all sizes	2 85 *a* — —
Clinch nails, 1½ to 1¾ inch	5 00 *a* 5 25
do. 2 to 2¼ inch	4 75 *a* — —
do. 2½ to 2¾ inch	4 50 *a* — —
do. 3 inch and longer	4 25 *a* — —

TIN PLATES.—Duty, 1 1-10 cents per pound.

*I. C. charcoal, 10x14, per box	6 75 *a* 7 00
*I. C. coke, 10x14	5 50 *a* 6 25
*I. X. charcoal, 10x14	8 75 *a* 9 00
*I. C. charcoal, 14x20	6 75 *a* 7 00
*I. X. charcoal, 14x20	8 75 *a* 9 00
*I. C. coke, 14x20	5 50 *a* 6 25
*I. C. coke, terne, 14x20	5 25 *a* 5 50
*I. C. charcoal, terne, 14x20	5 75 *a* 6 25

ZINC.—Duty, sheet, per lb., 2½ cents.

Sheet, (cask) per lb	— — *a* — 6½
Sheet, (open)	— — *a* — 7

SOLDERS.

No. 1	— 9½ *a* — 10½
No. 2	— 9 *a* — 9¼

STONE.—Cargo Rates.

Amherst Freestone, in rough, per cubic foot	— — *a* — 85
Berlin Freestone, in rough	— — *a* — 95
Berea Freestone, in rough	— — *a* — 75
Brown-Stone, Portland, Conn	1 25 *a* 1 50
Brown Stone, Belleville, N. J	1 00 *a* 1 50
Granite, rough	— 60 *a* 1 25
Canaan Marble	1 25 *a* 1 50
Dorchester, N.B., Stone, rough, per foot	— — *a* 1 03

PAINTS.

*Carmine, American, per lb. gold	5 00 *a* 5 50
Chalk, per lb.	— 00¼ *a* — 00⅜
China Clay, per ton gold	20 00 *a* 22 00
Chrome yellow, dry, per pound	— 12½ *a* — 28
Lead, red American, per pound	— 7 *a* — 8
Lead, white American, pure, in oil	— 7½ *a* — 8
Lead, white American, pure, dry	— 6¾ *a* — 7¼
Lead, white English, pure, in oil gold	— 10 *a* — 10½
Litharge	— 7 *a* — 8
*Ochre, Fr., dry, per 100 lbs	1 50 *a* — —
Ochre, ground, in oil, per lb	— 6 *a* — 15
Ochre, Vermont, per 100 lbs	— 75 *a* 1 00
*Orange Mineral, English gold	— 9½ *a* — 10
Paris White, American	— 1¼ *a* — 1½
Paris White, English, prime	— 1¾ *a* — 2
Paris Green	— 15 *a* — 28
Plumbago paint, patent, per lb	— — *a* — 25
Putty, per lb	— 1¾ *a* — 2½
Spanish Brown, dry, per lb	— 1½ *a* — 1¾
Spanish Brown, ground in oil, per lb	— 8 *a* — 9
Venetian red, per cwt	1 75 *a* 2 00
*Vermilion, Chinese, per lb	— 80 *a* — 90
*Vermilion, Trieste	— 70 *a* — 80
*Vermilion, quicksilver, bags gold	— 55 *a* — 57½
Vermilion, American, common	— 15 *a* — 18
Whiting, per 100 lbs	— 40 *a* — 75
Zinc, white American, dry, No. 1	— 6½ *a* — 7½
Zinc, white American, No. 1, in oil	— 8 *a* — 10
*Zinc, white French, dry, (Red Seal,) gold	— 8 *a* — 8¼
Zinc, white French, in oil gold	— 10 *a* — 10½

VARNISHES—PER GALLON.

American Wearing Body	3 50 *a* 4 00
Coach Body	2 35 *a* 3 50
do do	1 80 *a* 2 00
Furniture	1 25 *a* 2 50
Black Asphaltum	1 00 *a* 1 50
Brown Japan	1 00 *a* 1 20
Liquid Paint Dryer	1 35 *a* 1 75
Harness, (black)	3 00 *a* 4 50
Shellac, Spirits	3 00 *a* 3 50

CEMENT—PER BARREL.

Portland (imported)	2 75 *a* 3 40
Portland (American)	2 50 *a* 2 90
Roman	2 80 *a* 3 25
Keene's, coarse	6 50 *a* 7 00
" fine	10 00 *a* 10 50
Martin's, coarse	6 00 *a* 6 50
" fine	10 00 *a* 10 50
Rosendale	— 90 *a* — —

DEADENING AND ROOFING MATERIAL.

Mineral Wool for Roofs and Deadening, per lb. — 1¼ *a* — 1½

HAIR.

Cattle, per bushel of 7 lbs	— 9 *a* — 12½
Goat, " "	— 15 *a* — —

SLATE.

Purple roofing slate, per square	$6 00 *a* 7 00
Green slate	6 00 *a* 7 00
Red slate	10 00 *a* 11 00
Black slate, Pennsylvania	5 00 *a* 5 25
Slate tiles, 1¼-inch, rubbed, per square foot	20 *a* — 25

PLASTER PARIS.

Duty.—20 per cent ad. val. on calcined; lump free.

Nova Scotia, white, per ton	2 80 *a* 3 00
Nova Scotia, blue	2 75 *a* 2 80
Calcined, Eastern and city, per bbl	1 00 *a* 1 10
Calcined, city casting	1 15 *a* 1 20
Calcined, city superfine	1 20 *a* 1 25

LIME—PER BARREL.

State, common	— 80 *a* — —
" finishing	— 90 *a* — —
Rockland, common	— 75 *a* — —
" finishing	— 90 *a* — —
Ground	— 80 *a* — —

Add 25 cents to above figures for yard rates.

FOREIGN WOODS.

MAHOGANY.

St. Domingo, crotches, ordinary to good, per ft	— 15 *a* — 20
St. Domingo, crotches, fine	— 20 *a* — 30
St. Domingo, logs, small	— 5 *a* — 8
St. Domingo, logs, large	— 20 *a* — 30
Frontera, Mexican, large	— 11½ *a* — 16
Frontera, Mexican, small	— 8 *a* — 10
Other Mexican	— 8 *a* — 14
Honduras	— 10 *a* — 15

ROSEWOOD.

Rio Janeiro, ordinary to good, per lb	— 2½ *a* — 8
Rio Janeiro, good to fine	— 5 *a* — 8
Bahia, ordinary to good	— 2 *a* — 6½
Bahia, good to fine	— 4½ *a* — 8
Honduras, per ton	10 00 *a* 20 00
Satin Wood, per foot	— 15 *a* — 60
Tulipwood, per lb	— 6 *a* — 12½
Lignumvitæ, small, per ton	10 00 *a* 20 00
Lignumvitæ, large	25 00 *a* 50 00

CEDAR.

Cuba, per superficial foot	— 12½ *a* — 16½
Mexican, small	— 8 *a* — 10
Mexican, large	— 10 *a* — 16
Florida	— 50 *a* 2 00

DOORS, WINDOWS, AND BLINDS.

DOORS, RAISED PANELS, TWO SIDES.

2.0 x 6.0	1¼ inch.	$ 67	—
2.6 x 6.6	1¼	— 95	—
2.6 x 6.8	1¼	— 99	—
2.8 x 6.8	1¼	1 04	—

DOORS, MOLDED.

Size.	1¼ inches.	1½ inches.	1¾ inches.
2.0 x 6.0	$1 23	—	—
2.6 x 6.6	1 52	1 93	—
2.6 x 6.8	1 57	1 85	—
2.6 x 6.10	1 59	2 01	—
2.6 x 7.0	1 62	2 09	—
2.8 x 6.8	1 62	2 99	2 57
2.8 x 7.0	1 69	3 17	2 69
2.10 x 6.10	1 79	2 26	2 84
3.0 x 7.0	1 87	2 45	3 00

INSIDE BLINDS.

Per lineal foot, 4 folds, pine	04 *a* — —
Per lineal foot, 4 folds, ash or chestnut	— 07 *a* — —
Per lineal foot, 4 folds, cherry or butternut	— 08 *a* — —
Per lineal foot, 4 folds, black walnut	— 10 *a* — —

DRAIN AND SEWER PIPE.

(Delivered on board at New York.)

PIPE, per running foot.

2 inches diameter,	$0 13	10 inches diameter,	$0 70
3 "	0 16	12 "	0 80
4 "	0 20	15 "	1 25
5 "	0 25	18 "	1 60
6 "	0 30	20 "	2 00
7 "	0 35	22 "	2 50
8 "	0 45	24 "	3 00
9 "	0 55		

GENERAL REVIEW OF THE MARKETS.—The condition of business in most of the markets under review has been somewhat unsatisfactory the past month. Although a large amount of stock was placed, dealers in most cases were obliged to make concessions, and prices have shaded materially from early expectations. The unsettled condition of the weather has retarded consumption somewhat, and buyers have not therefore shown any eagerness to lay in supplies in excess of actual needs. The outlook for the present month seems to offer encouragement, builders having now got fairly to work and pushing contracts rapidly forward. This has awakened demand to a considerable extent, and the prospects are that the month's business will make a very favorable showing.

THE MARKETS IN DETAIL.—In the lumber market the past month business has gone along in about the same monotonous form, and there is an absence of anything like animation to record. Dealers generally have been speaking in a discontented tone regarding the condition of the market, but still continue to express hopeful views of the future. Consumption during the present month promises to be very good, but there is much competition to furnish supplies to meet it.

In the brick market common hards have been in about the same condition as noted in our last report. Sellers do not appear to be very buoyant in their views, but as a rule are confident that with the more favorable weather for consumption, the market may be fairly maintained. Pale brick have had a somewhat better demand, and the market has stiffened up a little. Fronts have had a fair average demand and have been steady throughout; most of the fine pressed stock has commanded extreme figures without much difficulty.

In the lime market we find little or no change. The demand has improved somewhat, and is likely to reach good proportions during the present month. Supplies are fair, but not excessive, and former rates are maintained without much difficulty.

In the cement market a good demand has prevailed for Rosendale on local account, and a fair number of shipping orders have been executed. Foreign is reported at former rates, with a very good business doing, and a very cheerful and encouraging state of feeling has prevailed.

In the lath market almost former rates have been asked and obtained, with business fair and most of the offerings disposed of.

In the hardware market demand has continued very good, with a tendency toward an increase. Local wants have been fair, while from the interior the orders received, and those promised, afford basis for a movement fully equal to last season. Prices in most cases have ruled steady.

In the paint market about an average distribution of stock has taken place, and there is not much of interest to report on the general market.

In the metal markets American pig has found a good sale and dealers in all cases have refused to negotiate except upon a basis of full former rates. Manufactured iron has been without much change. Scotch pig has been selling a little more freely, but only in small lots, and bids at full former rates have been generally accepted. Domestic lead in pig has been very dull, with prices showing great irregularity and uncertainty, and figures as named having a nominal basis only. Tin in pig and tin plates have not found a very active or general demand, and the market has had a tame tone. Sheet tin has been fairly active in an ordinary jobbing way.

The Hudson River Tunnel.

The New York *Graphic*, of March 19th, contains an illustrated description of the proposed tunnel under the Hudson River, intended to allow railroad trains to run from Jersey City into New York city, and *vice versa*. The plan has met with much opposition, not because it was not desirable nor practicable, but because there are thirteen railway routes terminating at Jersey City and controlling nearly all the trade of the West; all are struggling to reach New York city, the great commercial center, and to enjoy the privilege and monopoly of crossing the inconvenient barrier formed by the Hudson river at a point where there is no hope of bridging it, on account of its depth, but particularly by reason of the obstruction which it would cause to navigation; this could not be allowed under any circumstances.

The opposition has at last been set aside, and the Tunnel Company argue that through the routes indicated there are now discharged into New York city the passengers and freight received from about 300 trains daily, including a large amount of mail and express matter forwarded by numerous ocean steamers. The transfer across the river between New York and Jersey City is constantly obstructed by delays incident to re-shipment, and especially to the uncertain movement of ferryboats during the fogs and ice blockades of winter.

The company, which now holds itself in readiness for work, intends to construct a tunnel of solid masonry, of sufficient capacity to permit the conveyance of all passengers and freight bound to or from New York city, without change of cars and without delay or hazard. The engineering difficulties, no doubt, are great, but with the experience gained at the present day in submarine tunnelling, they will be easily overcome, and it will be only a question of money. In regard to this the company say that there will be no difficulty whatsoever, and as to the opposition of Jersey City, now overcome, it could hardly have been expected that innovations upon present arrangements so radical as those contemplated in this project would be allowed without at least some show of remonstrance.

In regard to New York city, rights will have yet to be secured, as the streets are under the exclusive control of the local corporation. The proposed law enables the Tunnel Company to go under the streets, but confers no right to disturb the surface. Depot facilities or other needed accommodations can be acquired by purchase hereafter, in the usual way.

The gentlemen engaged in the project claim, with evident truth, to be possessed of ample capital, estimated at some $10,000,000. They also express themselves as convinced beyond a doubt of the feasibility of the undertaking and its vast prospective commercial importance. They are perfectly right in this; it will enable the company to convey passengers without change of cars from the South and West, as well as from Newark, Elizabeth, Paterson, and all local points, arriving at Jersey City, within six minutes thereafter to Broadway, New York. The company say that more than 400 trains of cars could be passed through the tunnel every twenty-four hours. Freight trains would have transit at night, and market trains in the early morning, all drawn by powerful engines made especially for this purpose, to be run by signals, without bells or whistles, consuming their own steam and smoke, or run with compressed air. All connecting railroads are to have an equal right to pass their passengers and freight through the tunnel upon the same terms.

In regard to the details of execution, we can state that the entrance to the tunnel on the Jersey side of the river is to be from Jersey avenue, on 15th street; the work is to extend thence to Hudson street and the river, about 3,400 feet; thence under the river, curving five degrees northward, to the New York bulkhead line, at or near the foot of Morton street, about 4,500 feet; thence curving slightly southward in New York, about 3,000 feet, to a point to be selected by the city authorities. The entire length of the tunnel and approaches will be about 12,000 feet, (with the depot tracks to be added thereto), being about one mile under the river and nearly three-quarters of a mile on each side. The track will be a heavy steel rail, ballasted with broken stones to five feet from the bottom of the tunnel, wherein can be located gas and water pipes, and pneumatic tubes if needed; while telegraph wires can be placed upon either side. For the purpose of expedition it is proposed to work from each side of the river at the same time, as many men can be successfully employed in excavating and laying brick, changing them every eight hours. Thus, by constant work, doing three days' labor every twenty-four hours—by which it is believed the work can be advanced 5 feet from each end every day—the whole work can very easily be completed within two years.

The tunnel was commenced in November, 1874, after extensive borings, for a year previous, in the bottom of the Hudson river, down to the depth to be occupied by the tunnel. A circular working shaft, 30 feet in diameter and 65 feet in depth, was then commenced 100 feet inland from the water, on Fifteenth street, Jersey City. After it had been sunk 20 feet, with perfected brick walls 4 feet in thickness, the further prosecution of the work was enjoined by the suit of the Delaware, Lackawanna & Western Railroad Company. The litigation occasioned thereby has been successfully terminated and all charter rights established. As before mentioned, when the necessary legislation is secured from our State, the work proposed will be resumed and forwarded as rapidly as possible.

A very serious error however is this: The company suppose that by the aid of compressed air, as applied in the patent therefor, obtained by its President, Mr. Haskin, in connection with other important appliances, they will be able to complete this work at much less expense than any similar work has ever been constructed. It is believed that its present capital of $10,000,000 will be abundant for that purpose. In its plan of construction no expensive coffer dam, caisson or Brunel shields will be needed. The use of compressed air introduced into the face of the tunnel, with sufficient pressure to hold in place, or keep back and prevent the irruption of silt, clay or water, will, it is believed by the company, overcome the difficulties usually experienced in constructing tunnels. The air pressure will also carry back to the working shaft, through pipes, all sand, mud or water that may accumulate in the heading during the course of the excavation.

This plan of Mr. Haskin is not only utterly impracticable, but absurd, and in order to explain its absurdity we can do no better than repeat what we said in our January and May numbers for 1875, (pages 7 and 107). When we first heard of it, we wrote in our January number, 1875:

"Mr. De Witt Haskin, of California, has patented an improvement in the manner of constructing submarine tunnels, which is based on the plan adopted to sink the caissons for the foundations of the towers of the East River bridge, and of the piers of the bridge over the Mississippi river at St, Louis. He employs compressed air, which keeps the water back and also partially resists a collapse of the soft solid material. After his plan, the workmen labor in a kind of chamber containing compressed air; but instead of working at the bottom downward in a caisson open below, they work at one side and thus forward, the compressed air being expected to resist the inward pressure until the masonry following the digging is completed. Behind them are air-locks to allow the men to enter and leave the chamber with compressed air. A great mistake in the plan is that the inventor discards the caissons and shields proper; he expects that the air pressure alone will prevent any loose boulders, stones, or quicksand from coming down upon the workmen, as if the law of gravitation would not prevail in compressed air. He expects to use fifty pounds pressure, and we agree that this is sufficient to keep back a column of water 100 feet high, so that with this pressure he might descend 100 feet below the surface of the water, provided the air finds no escape by other channels than where the water comes in, and also that the water enters only in very narrow channels. If the water finds a hole to enter say as large as an inch, the air pressure can not keep it back, but will pass beside the water upward through the same channel by which the water descends, acting in the way like the syphon of wine testers, which can not hold the liquid back when the lower opening is not very narrow; this compressed air acting against the common air precisely as common air pressure acts against rarefied air.

As an illustration of the patentee's want of hydrostatic experience and judgment, we copy one of his statements: 'If a jet, seam or small stream of water is encountered, I supply a temporary shield of canvas leather, or other flexible intergument to the wall, against which the pressure instantly forces it and seals the leak.' He forgets that the same high pressure will prevail between the particles constituting the walls of the tunnel, and the application of a piece of leather will not change this pressure into a vacuum—his leather will not stick."

In our May number for the same year, we added as follows:

"In a previous issue we mentioned a patented invention of Mr. DeWitt Haskin, of California, intended to tunnel rivers, based on the mistaken notion that compressed air can keep water back when it tends to infiltrate from the sides of an excavation. The success of the caissons used for the foundations of the East River suspension bridge, and the bridge across the Mississippi River at St. Louis, in which compressed air kept the water below the level on which the workmen were performing their labors, has turned Mr. Haskin's head, so that he himself has not only been induced to imagine that compressed air could keep back water which infiltrates from the sides or from above, but he has even succeeded in obtaining a patent on a plan of operation based on this absurd supposition; on the basis of this patent he has succeeded in forming a company with $10,000,000 capital, of which he is President; George C. French, Vice-President; L. C. Fowler, Secretary, and Wm. H. Paine, Consulting Engineer. We trust that these gentlemen, if not already convinced of the impossibility of tunnelling on such principles, will soon see the error of their ways, and employ other means to accomplish their no doubt desirable project—the tunnelling of the river which forms the western boundary of the metropolis of America."

We will now add to the above that Mr. Haskin, and others interested with him, can easily convince themselves, by some simple experiments, of the essential difference between tunnelling downward in a caisson with compressed air and tunnelling forward in this same way. By placing an inverted tumbler or a small diving-bell in water, or in mud, the air will remain inside and the water or soft mud will find its level below, but as soon as the tumbler is put in an inclined position the water or mud will partially enter and find its level, flush with the highest point where the air can escape, and if the little caisson is placed horizontally, the water or mud will enter its lowest portion, while the compressed air will escape by its very pressure through all channels it finds or can make in its upper portion, and the whole will soon be filled, while the air will have escaped forward and upward through all possible crevices. This tendency of air to escape upward is so strong, that in the Brooklyn caisson the air kept oozing out through the spaces between the masonry on top of it, as if it were a sieve, and for this reason the caisson on the New York side was lined interiorly, sides and top, with sheet-iron, so as to make it air-tight. If in this case it was found necessary to line the sides of a caisson to render them air-tight, how will it be possible to prevent compressed air from finding its way out forward and upward through the soil in a horizontal tunnel.

We positively assure those interested that if they think it possible to work the "caisson principle" in a horizontal direction, they delude themselves, as it is only adapted to be worked downward.

Home Department.

Diphtheria in Milk.

We believe it is an established fact that milk is frequently an agent for the diffusion of disease. Epidemic outbreaks of typhoid or enteric fever have more than once been traced to a common supply of infected milk. In these cases, however, the injurious character of the milk has been attributed to its contamination from external sources, as by means of impure air or impure water, containing the germs of the disease. But a more startling theory concerning the epidemic agency of milk has recently been put forward in England, and demands attention from our sanitary authorities in this country, in view of the present prevalence of diphtheria in so many localities.

It is possible, not to say probable, that diphtheria has its origin in the diseased condition of milch cows. Such at least is the inference which must be drawn from the carefully observed facts of two epidemics in England, both of recent occurrence, one in North London and the other at Woking. They indicate that a disease of the udder known as garget, and generally regarded by dairymen as insignificant, may so affect the quality of the milk as to produce diphtheria in the consumers.

Inquiry leaves no doubt that milk from cows having garget finds its way into the market in considerable quantities. Only a portion of the udder is usually attacked by the disease, and the milk yielded by the other quarters does not manifest any such change in quality as would ordinarily lead to its rejection. Indeed, so indifferently is the affection looked upon by men having the charge of cows that they seldom inform their employers of its existence. A member of the Pathological Society of London, who was led to investigate the subject lately, found several cases of garget among his own cattle, although his bailiff had not thought them important enough to mention.

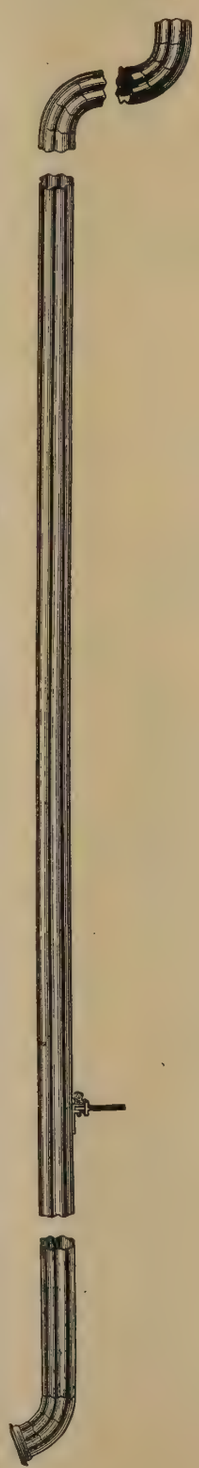
The circumstances of the North London epidemic of diphtheria satisfied the sanitary officer charged with its investigation that the disease was distributed by the milk supply, and that the milk had not been contaminated by any influences from without. These conclusions are confirmed by the like opinions of distinguished physicians to whom the facts have been submitted. They naturally lead to the question whether any special disease could prevail, without attracting particular notice, among the cows from which the milk came. The answer is that garget is just such a disease. And the belief that this apparently slight affection in cattle may be transformed into diphtheria, or may induce that disease in the human subject, is strengthened by the recent diphtheritic outbreak at the Princess Mary's Home at Woking. Garget was found to be prevalent on the farm which furnished milk to that institution.

The proceedings of the Pathological Society of London in reference to this possible connection between diphtheria and disease in cows supply abundant evidence of the gravity with which the medical profession regard the subject. It has been referred for investigation to a committee of highly qualified physicians, one of whom is Dr. Burdon Sanderson, and the results of their inquiry cannot fail to be important. In the meantime, ought not something in the same direction be done in this country?

Use of Water-Glass for Bleaching and Washing.—We are informed that Professor Meyer, of Chur, has bleached calicoes cheaply and successfully by the use of water-glass or silicate of soda, while he found this method to be of special advantage for cloth intended for indigo-blue, which, though not required quite white, must still be perfectly free from all fatty or greasy substances. This object was obtained by only two hours' boiling in an open vessel with a lye made of 2½ gallons of water and ½ pint of water-glass of silicate of soda, of 20° B.; the cloth is afterwards twice boiled for an hour in clear water, and washed twice in the washing machine, which completes the process. It is necessary to introduce hot water for the boiling, as otherwise the dissolved resinous substances would be precipitated. The water-glass, it would thus appear, acts much more energetically in removing grease than a much stronger solution of soda, which would cost more. Water-glass is also used with great advantage for cleaning dirty machine waste; if this material is boiled in a weak solution the grease will rise to the surface in a few minutes, when it can be skimmed off, and, when dry, the waste used over again.

Expanding Water Conductors.

It is the opinion of experts in patented inventions that the best proofs of the value of a patent are the infringements and lawsuits growing out of them. This opinion is no doubt well founded, and we may on the other hand accept as a truth that when no one cares for a patent it does not amount to much. Judged from this standard, Austin's patent for expanding water conductors or rain spouts must be very valuable, as it has been largely infringed upon, a lawsuit has resulted, ending in a perpetual injunction, and the appraisement of gains and advantages, with damages to the patentee. This test case will undoubtedly put an end to other infringements.



That an expanding conductor cannot burst from the expansion of water freezing inside is almost self evident. In a round conductor the material has been stretched to its fullest extent, and any further stretching must necessarily end in a rupture; but when the conductor is corrugated lengthwise from end to end, as represented in the adjoined engraving, it is evident that when water freezes and expands inside, no damage can result, as the only effect of the expansion will be to change the form of the corrugations. As shown in our engraving, the elbows are also corrugated, which is important, as generally at these points the most damage is done by frost.

A very important additional improvement is the method of fastening these pipes to the wall. A staple with a point at one end and a hole at the other, is driven into the wall; a shank is soldered to the conductor, so that the opening of the staple comes just above the hole in the shank, when a strong pin is inserted through both holes. The conductor is then very secure and cannot become detached unless the pin is taken out, when its removal becomes very easy.

These conductors are generally made of galvanized iron, but can be made of all sheet metals. The regular sizes are 2, 3, 4, 5 and 6 inches in diameter, all with well fitting shoes, and elbows of three different angles.

The use of these water conductors is increasing rapidly, and we recommend all interested to address Austin, Obdyke & Co., 1705 and 1725 Chestnut street, Philadelphia, for illustrated price-list.

Ill-Natured Men.

Says the New York *Herald:* "There are men in the world who are in such a chronic state of ill humor that one suspects them of living exclusively on sour apples, which have set their teeth on edge. They are in society about as valuable as a grumbling toothache. They go round throwing vitriol on people's clothes and pepper into people's eyes. If there is anything in this world that makes a man wish that the experiment of creation had never been tried, or convinces him that so far it is a signal failure, it is the presence of the human chestnut burr—the constitutional growler. Mind reading is all very well as a novelty, but as one of the regular things of life it would certainly be intensely disagreeable. There are qualities of harmless little disguises which we put on for the sake of making things smooth; little slender compliments which really do make life more pleasant and agreeable. There are times when we say something just a little bit aslant from what we think, a little more or a little less, and it makes everybody feel happy; whereas if the faculty of mind reading were largely distributed we should be compelled to say just what we thought, and so give offence. May Edison never invent and patent a mind-reading machine and sell it at such a cheap rate that everybody can possess one. We should all be consumed by curiosity and buy the thing; we should always be fitting it to somebody's brain at just the wrong moment, and we should get ourselves into more trouble on New Year's day than we could get over during the next twelve months."

A Cheap Cologne Water.

The only perfume which never seems to offend any one and leaves no unpleasant tang behind it is that of cologne water, which stimulates while it soothes the senses, and suggests a pleasant wholesomeness instead of any sickish sweetness, as the best of the extracts and essences and bouquets are apt to do. We do not mean, of course, the cheap and common cologne water of the druggists, which is usually very much worse than none at all, and is wont to leave, after drying, the smell of burned sugar where it has been used often, as it is made of the poorest spirit, and necessarily without subsequent distillation, disregarding the fact that it requires the strongest proof or rectified spirit to dissolve the combined oils properly where the process of distillation is not used. Indeed, with no trouble at all, any one can make in his own store-room a better article of cologne than that which is usually bought, by thoroughly dissolving a fluid dram of the oil of bergamot, orange and rosemary each with half a dram of neroli and a pint of rectified spirit. As good as can be made out of cologne itself, however, is also quite as comfortably prepared at home as at the chemist's—at so much less than the chemist's prices that one feels warranted in using it freely—simply by mixing with one pint of rectified spirit two fluid drams each of the oils of bergamot and lemon, one of the oil of orange and half as much of that of lemon together with three-quarters of a dram of neroli and four drops of the essences of ambergris and musk. If this is subsequently distilled it makes what may be called a perfect cologne, but it becomes exceedingly fine by being kept tightly stoppered for two or three months to ripen and mellow before use.

A Man who Burst.—In the *Vierteljahrsschrift für Gerichtliche Medicin*, Dr. Bremuse gives an account of a man who literally burst from taking four plates of potato-soup, and many (how many is not stated) cups of tea and milk, followed by a large dose of bicarbonate of soda to aid digestion! His stomach swelled enormously, and tore the diaphragm on the right side, causing immediate death. The timely insertion of a stomach tube to let the gas out, would have saved him.

How to Poison a House.

The following, which we extract from the New York *Times*, agrees so well with our own ideas on the subject, that we cannot refrain from publishing it.

"Many remarkable and sudden outbreaks of disease and cases of sudden death have occurred during the past few years in houses in New York, where every sanitary circumstance seemed favorable. The favorite child of a wealthy family has been suddenly carried off by diphtheria, where the house was on the hill with the drainage apparently excellent, and the rooms were never crowded or overheated. Another, living in the most airy and elevated portion of the city, has suddenly been seized with that most mysterious and terrible of the 'foul air diseases,' spinal meningitis, and, under every care and precaution which wealth could supply, has died in great agony. Here a family, living in what might be called a palatial house, has been attacked with typhoid and the children or other members have struggled for months with death. Virulent fevers have broken out in the finest houses, and some of the handsomest quarters of the city have not been exempt from pestilential diseases. Malaria has been everywhere, and Fifth avenue has felt it as well as the streets made over old water pools. It should be remembered, too, in a sanitary point of view, that the best parts of New York ought to be utterly exempt from these foul-air diseases. There is nothing 'providential' in the sense of mystery in these sudden deaths of the children of the rich. They are as much the effect of law as would be the drowning of these same children, if they had been put under the water, Modern science can as certainly reduce the death rate from foul air diseases as it can elevate the land or keep down the water on the banks of a given lake. A skillful modern prison and sanitary inspector has said that if he discovered a case of smallpox or diphtheria in his wards, he should at once charge himself with defect of administration.

"The best parts of a city cannot of course, escape the diffusion of poisonous gases from the worst parts. Moreover, nuisances like our gas works and bone factories contribute their poison for miles on every wind. But each house in New York has a private and individual machine for diffusing the germs of diphtheria or the seeds of scarlet fever, sore throat, cholera infantum and typhoid. Almost every bed-room in the richest quarters of the city has a private connection with the sewer, in which are the infecta of typhoid patients, or the fermenting and disorganizing animal and vegetable matter, which either produce the seeds of disease, or furnish the fertile soil for these seeds to ripen in. The especial means of infection in many diseases is by sewer products. In the Croton water-bowl there is, of course, a drain-pipe connected with the main drain of the house. Ordinarily the water-traps keep the gases back. But some night, when the sleeper is most unprotected against such influences, and the vital energy is at the lowest, a flood from the sea or rain fills the sewers, or a strong wind blows through them. The gases are forced violently back. The water in the trap-bend forms no obstacle. They rush up through the chamber water-pipes, and diffuse themselves through the apartment. Had we a supernatural power of sight, we should undoubtedly see on such a night a cloud of microscopic sporules of scarlet fever, or currents of diphtheria germs, or showers of typhoid seeds scattering themselves through the house, and entering the systems of the unhappy sleepers. Such as are vigorous would throw them off, but with the weak and the young the seeds would take root, spring up and bear fearful fruit. The next day there would be a "providential" case of malignant fever in the house, and in a few weeks a life would extinguished, whose loss many coming years could not cause to be forgotten.

"The only prevention against such escapes of gases is to banish all water drains from the bedrooms, and to put escape ventilation pipes on the traps. We must return to the old bowl and pitcher. The pipes should all end in the bath-room; all water be drawn from there, and this room ventilated so as to permit no contamination of the house, The little extra trouble would be well repaid by the safeguard to life. Such an arrangememt excludes all chamber bath-rooms. But safety is the first thing, convenience afterward."

Improvements on Coney Island.

The New York and Coney Island Steamboat and Pier Company have 150 men at work building their 1,000 foot pier into the ocean not far from the Prospect Park and Coney Island Railroad depot, and just opposite the unused structure which was formerly on one of the wings of the Centennial building in Philadelphia, and which will be used this summer as the depot of the New York and Sea Beach Railroad. Like the Long Branch pier, described in our April number, it will be built on hollow iron piles, which will sink by their own weight, the sand and water being pumped up through them from the bottom. They will be embedded in the sand 18 feet. The structure is to be 120 feet wide, and two stories high.

The Atlantic Garden, the large pavilion-like place of entertainment, which was so popular last year, has changed its name and character during the winter; it is now called the West Brighton Beach Hotel. A second story has been added, in which are now exhibited 80 furnished rooms, and the piazza has been widened to a depth of 135 feet in front and of 90 feet on the east side.

The new railroad (New York and Sea Beach) will have its starting point at the foot of 35th street, South Brooklyn. This is a point on the shore of Gowanus Bay, near which Brooklyn yachts have been accustomed to rendezvous. Work on the uncompleted part of this line has been commenced, and it will be finished before the 4th of July. The road is already completed from Coney Island to Weir's Hill.

Two-hundred and fifty men are employed on the extension of the Prospect Park and Coney Island Railroad, which is to run from Cable's Hotel to the west point of the island (Norton's & Murray's). The road will run behind most of the intervening small hotels on the beach, but in front of the Centennial building, and directly over the site of the building used by the Children's Aid Society. President Andrew R. Culver has bought the Buckingham Hotel, just east of the depot, and the Children's Aid Society will use it.

Contracts have been given out for the building of an east wing on the Brighton Beach Hotel, the lower part of which will be opened this month. This will also be done at the Manhattan Beach Hotel about the same time. Elliott Brothers & Co., of New York are building a variety theater in the rear of the Buckingham.

William Engerman has secured a 10 years' lease from the Commissioners of Common Lands of the town of Gravesend of 10 lots at the east end of the Boulevard, adjoining the Concourse, comprising about 800 by 130 feet, on which he will erect additions to his pavilions.

Bee Stings for Rheumatism.—The *Praeger Wochenblatt* contains the following in regard to the cure of rheumatism by the means of bee stings. A correspondent says that his wife having suffered so much from rheumatism as to be unable to enjoy any rest or sleep for the space of six months, the right arm being almost lame, preventing the sufferer from doing any household work, making her even unable to dress or undress herself, and having heard that a farmer, quite incapacitated by rheumatism, had been accidently stung by bees, and thereby got entirely cured, he persuaded his wife to try this remedy, as the pain from the sting of the bees would not be greater than that already suffered. Three bees were therefore laid and pressed upon the right arm for a considerable time, in order that the poison bladders of the insects should entirely empty themselves. The effect produced was astonishing, as the lady, even on the first night, was enabled to enjoy a long, good sleep, the first time for at least six months, the racking pain being entirely gone. The arm was, of course, swollen greatly in consequence of the sting, but the swelling gradually disappeared upon the application of some cooling lotion. All pain was gone, the lame arm recovered its previous vigor, and not the least sign of rheumatism has since showed itself. This statement is to be taken "*cum grano salis.*"

Miscellaneous and Advertising.

Nickel-Plating.—Wenzel's patent perforated carbon box anode for holding grain nickel. A. C. Wenzel, 114 Center street, New York city.

The loss of A. T. Stewart's remains is a strong argument against advertising. If he had never advertised, his remains would have rested as quietly in his tomb as the remains of the fossilized merchant do in his store.

Oswego Starch Factory,
Oswego, N. Y., October 28, 1878.

H. W. Johns, 87 Maiden Lane, New York:

Dear Sir: We have several acres of your Asbestos Roofing on our buildings; the first roof put on fifteen years ago is in good condition, and we prefer it to any other. Yours respectfully,

T. Kingsford & Sons.

According to a patent of Baird, of Glasgow, the peculiar tendency of most oils and lubricants to oxidation, is removed by heating them in pans with from 2 to 10 per cent of sulphur, according to the nature of the oil, until the sulphur is melted, and then allowing them to cool.

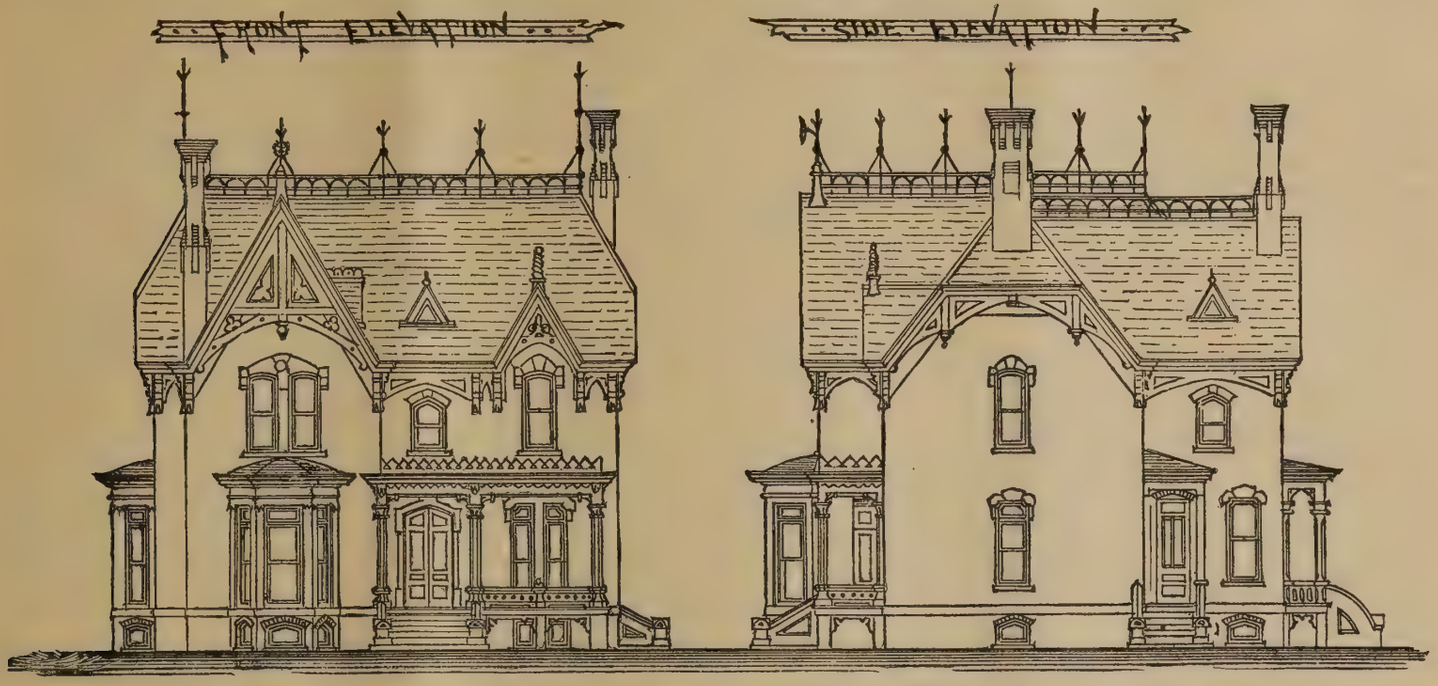
An English firm have patented a novelty for window blinds in imitation of lace. The groundwork of the blinds is a stone-colored cambric, on one side of which is printed in black and white an elegant lace pattern, the effect of genuine lace being imitated with remarkable fidelity. The cost is said to be very moderate.

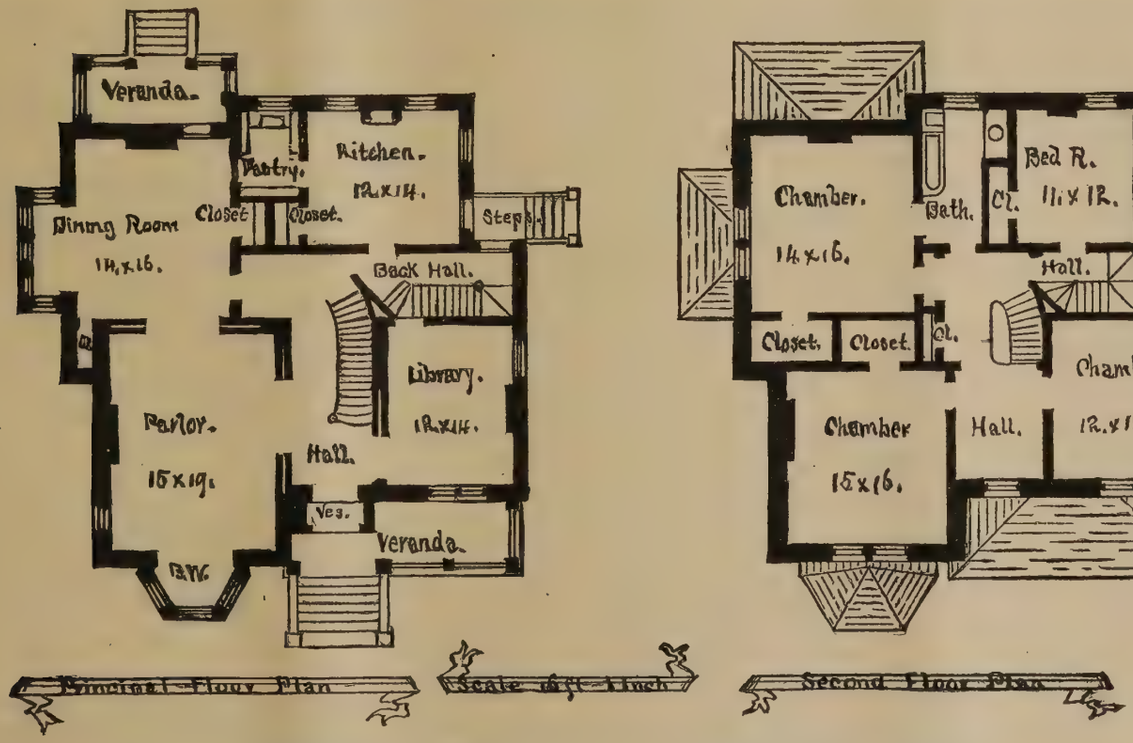
The Ingersoll Rock Drill Co., of 1½ Park Place, New York, find a steady demand for their drills and air compressors, from all sections of the country, where mining or quarrying operations require their employment. This is a result of their superiority, both in design and working qualities, and we commend their general use.

Nothing is more important than to have boilers provided with reliable safety valves, as every one having to do with steam knows. The Consolidated Valve Company, of 51 and 53 Sudbury street, Boston, who are operating under the patents of E. H. Ashcroft and George W. Richardson, are manufacturing just such valves, as evidenced by the numerous trials to which they have been subjected.

Heald, Sisco & Co., of Baldwinsville, N. Y., invite parties to send for circular containing a description of their steam engine, which they offer to furnish complete with feed pump, water heater, governor and throttle, cylinder lubricator, balance slide valve, and wrenches, for $250. The reputation which this firm bears is a sufficient guarantee of the superiority of this engine, and an assurance of every representation being fulfilled.

The important question as to which water-wheel is best to use is met by the response of a score of manufacturers, each of course claiming superiority. However substantial these claims may be we are not prepared to say, but it is with gratification that we note the steady progress the Leffel wheel has made in public favor, since its introduction. The manufacturers, Jas. Leffel and Co. of Springfield, Ohio, claim that 7,000 of these wheels have been sold, which seems a sufficient guarantee of their value. In actual trials these wheels have recorded remarkable results, and the experience of those who have them in use confirms the claims of the manufacturers as to the results these wheels are capable of.





DESIGN FOR BRICK COTTAGE, COSTING ABOUT $5,000.

Design for a Brick Cottage.

The plans and elevations given on this page were executed by Croff & Camp, architects, of 335 Broadway, New York, and represent a cosy suburban cottage erected on a double lot in the village of Ballston Spa, N. Y.

The construction is of common red brick, with light-brown Nova Scotia sandstone caps and sills. Basement of rubble native stone, and openings in basement trimmed with brick. All exterior brick-work of one selected shade; chimney caps of brick, coped with stone flag; roofs slated, cresting of a light cast-iron pattern, terminated at the salient points with lightning rods. Bay windows and porches of wood; also box gutter cornice, bracket frieze, etc., painted and sanded to match the color of Nova Scotia stone-work below. The brick walls are furred off on the inside and prepared for papering, by floating the brown coat, and hard finishing the ceilings, at angles of which with the walls are neat stucco cornices. Center pieces of a harmonious design are placed in the parlor, hall, library, dining-room, upper hall, and three chambers. Front stairs constructed entirely of black walnut—risers, treads, balusters, rail and newel. Rear stairs of pine, with black walnut rail, newel and balusters only. Stairs to cellar and attic close.

Plumbing confined to bath-room and kitchen, and of the best workmanship and materials. Gas piping placed in every room and hall; chimneys constructed with fire-places, and a heater placed in the cellar under hall. All window heads are finished square inside of the parting bead, and the glass is first quality. The painting is in three light tints inside—panels gray, stiles and rails rose, and moldings and chamfers vermilion-brown. Bronze furniture on front doors, bell, etc.

The interior arrangements are very convenient, all the rooms being of easy access to each other. On the first floor there is a parlor, 15 × 19 ft.; library, 12 × 14; dining-room, 14 × 16; kitchen, 12 × 14. On the second floor there are four good sized chambers and bath-room.

The grouping of the rooms is unusually close and compact, leaving no long halls, so cold and wasteful, hence the house is an economical one for a cold climate; and its steep roof will shed the snow so fast as not to strain its timbers, which therefore may be light.

The architects will be pleased to give any further information about this cottage, either in person or by letter. Its cost would now be in the vicinity of $5,000, finished plainly.

Improved Tenement Houses in New York.

A number of capitalists in New York city have formed an association to build a model tenement house somewhat on the plan of the Peabody tenements in London. They have agreed to form a stock company with a capital of $1,000,000 of which ten per centum shall be paid in when the organization is completed. With this sum it is proposed to erect a tenement building somewhere between Sixtieth and Eightieth streets and Second and Ninth avenues, which, while it will furnish greatly superior accommodations to the wretched abodes in which men of the laboring class are now obliged to live, will at the same time return a fair profit on the money invested.

It has been ascertained that in London the Peabody buildings invariably improved property in their neighborhood, and that they were always fully tenanted, and yielded an annual dividend of four and one-half per centum. Similar buildings can be erected in this city and made to yield an annual income of more than 6 per centum on the money invested. It is proposed to secure sixteen lots of ground, situated at the end of a block, so that a frontage of two hundred feet on three streets can be obtained, and on this ground to erect the first building, which will be of brick, five stories in hight, with a central court yard one hundred feet square. There will be three entrances to this courtyard, one from each street, and the entrances to the building will be from the court yard. A central hallway eight or nine feet wide will be laid out on each floor, continuing around all parts of the building. Wide staircases will connect these floors, and there will also be one or more elevators in the building. The rooms will be arranged on either side of this hallway, and be lighted and receive air either from the street or court yard. Every room in the building will receive direct light and air, and there will be no dark or inner rooms. The building will be in charge of a janitor, who will have general supervision of the building and enforce all necessary sanitary measures. The rooms will be lofty, and of large dimensions.

All washing and drying of clothes will be done on the roof, which will be surrounded on all sides by a parapet brick wall six feet high. It is thought that the better class of the tenement population will be glad to avail themselves of such an opportunity to secure a pleasant home. While no offensive system of espionage will be established, yet any tenant who proves himself of a quarrelsome temperament or fails to observe the sanitary regulations of the house will not be permitted to remain, while, as a further inducement for the tenants to keep their rooms clean and in order, it is proposed that one-third of all the profits above six per centum shall be divided among those tenants who pay their rent promptly and prove themselves honest and industrious, and observe all the sanitary regulations of the building.

It is the intention of the association to call for ten per centum of the capital stock, and at once begin the erection of the building. When this building is completed, if it shall prove a profitable investment, another ten per centum will be called for and another building erected, until ultimately the entire capital stock of one million dollars is expended. Of the profits above six per centum one-third will be distributed among the tenants, while the other two-thirds will constitute a reserve fund for the erection of other buildings.

The men connected with the project are all men of wealth and put their own money into the scheme, expecting that it will pay a good profit. The rooms will be rented singly or in suits, and the rent will be as low if not lower than that now charged for the filthy, unhealthy accommodations in the ordinary tenement houses.

CINCINNATI EXPOSITION.—At the last meeting of the Cincinnati Exposition commissioners it was reported that the bids for the erection of the Exposition buildings had been opened, and that the trustees had decided that the fund would be sufficient to erect the buildings, pay the necessary outside expenses and leave a balance of $13,000. This was for a three-story building. The following contracts for the building were reported: carpenter work, 29,950; brick work, $30,500; cut-stone, $6,868; iron, $22,000; slate, tin and galvanized iron, south wing, $6,600; slate, tin and galvanized iron, north wing, $3,738.75.

About Advertising.

My success is owing to liberality in advertising.—*Bonner.*

The road to fortune is through printer's ink.—*P. T. Barnum.*

Success depends upon a liberal patronage of printing offices.—*J. J. Astor.*

Frequent and constant advertising brought me all I own.—*A. T. Stewart.*

My son, deal with men who advertise. You will never lose by it.—*Ben Franklin.*

How can the world know a man has a good thing unless he advertises the possession of it?—*Vanderbilt.*

People are quite apt to go where their attention is called, and, if they find things as represented, will purchase there in preference to spending their time in seeking elsewhere.—*Phil. Chemist and Druggist.*

Where is "parts unknown?" asks a correspondent of the *Danbury News.* To which Bailey answers: "Where they don't advertise." And though Bailey does say it, this is no joke.

Advertising is the oil which tradesmen put in their lamps. They that are unwise put no oil in.

An advertisement is a window through which all the world may look into your shop and see just what you wish it to see—no more, no less.

A good advertisement in a newspaper pays no fare on railroads; costs nothing for hotel bills; gives away no boxes of cigars to customers, or merino dresses to customers' wives; drinks no whisky under the head of travelling expenses, but goes at once and all the time about its business free of expense.

DEATH OF GEISSLER.—Dr. Heinrich Geissler, the maker of the vacuum tubes named after him, and who gained an international reputation as a physicist and experimenter, recently died in Bonn, Germany, at the age of 64 years. He devised many important instruments and made valuable researches; for instance, on the density of water, the expansion of water, the preparation of red phosphorus by the electric current etc.

New Publications.

Hints to Plumbers and Householders. By W. L. D. O'Grady. New York: American News Co.

This is a highly useful publication at the present time, when the injurious results of imperfect plumbing in large cities are manifesting themselves on all sides—in fact, as the author says in his preface, "the plumber holds in his hands the keys of life and death." If he is skillful and conscientious, he can guard off man's greatest enemy; if he is not, he opens the door to death. He should be the householder's friend, and the latter should appreciate good work; but, alas! misunderstanding in many matters often makes them enemies. How householders frequently act against their own interest by trying to save a few dollars, is illustrated by the following fact related by the author:

"In New York, a very wealthy and really well-meaning, though miserly, old landlord, got an estimate from a conscientious plumber for a magnificent brown-stone house. The plumber was told to figure low, and did figure low, bringing out his total for strictly necessary work, done cheaper than usual, to $850. The old man was horrified, and straightway betook himself to another so-called plumber, who didn't take any time in figuring, but learning the amount of the first estimate, offered to do it for $600. He got the job. Several people died in that house within the year, and the first man was called on to make the repairs that had become absolutely indispensable. His first discovery was that the soil pipe, carefully concealed underground (where, it will be remembered, we have said it should never be), was made of No. 22 sheet-iron stovepipe and had rusted through from end to end. The house was thus literally standing on an open cesspool. The bill for repairs was $300, and the damage to the building amounted to at least as much more, so that cheap plumbing in this case did not answer. And it never does answer."

The book is divided into chapters, entitled "Traps," "How to Fight Sewer Gas," "Practice and Precaution," "The Plumber's Worst Enemy," "Gas Fittings and other Fittings," and "Some Things Worth Knowing." The book should be in the hands of all plumbers and parties owning or living in houses containing plumbing work.

In recommending this book, we do not wish to be understood as endorsing all the author's opinions. We fully endorse his rule, never to have any brick or terra cotta sewer connections or traps inside a building, and never to have them buried in the earth; a crack or a leak will soon saturate the earth around them with the pestilential liquid and poison a house; they should be of cast-iron, above ground, so as to be open to inspection and readily to detect any defect. But we do not approve of the now so much recommended system of having the pipes reach above the roof of each house, so as to ventilate the sewers all over the city. We have often smelled the bad emanations entering the windows of our bedroom during the night, and have corrected the evil by sealing up such pipes, either by a trap or absolutely closing them. Much less do we approve of the plan of having the vertical discharge pipe connecting the water-closets to the sewers, open at both ends, above and below, of which plan the book gives a drawing. It is true he places these open pipes outside the building, so that the odor does not enter the house directly; but we do not see what is to prevent it from occasionally entering the neighboring windows. The pretended odorlessness of this method appears to us very doubtful, especially when in winter the pipes become choked up by frost. We think it very bad advice to expose sewer pipes to frost; they will certainly be closed by ice, overflow, form large icicles, and when the frost ceases become a most abominable nuisance for many days.

Report on Bridging the Mississippi River between St. Paul, Minn., and St. Louis, Mo. By Brevet Major-General G. K. Warren. Washington: Government Printing Office.

This book, containing some twenty interesting diagrams and thirty large maps, consists of the printed reports of the surveys made by order of the United States government, intended to solve the great question of bridging the father of waters, in such a manner as to preserve navigation and at the same time afford proper accommodation to railroads. These investigations were authorized in 1866, when Gen. Warren, Major of Engineers, was appointed to make the necessary surveys upon the subject. This was done, and maps prepared during 1867, 1868 and 1869. In 1870 the General was detailed to the charge of the United States lake survey; since that time the report has been delayed, in part by his serious illness, until in 1876 further surveys were found necessary, on account of additional bridges that had been built since 1869, and at last, in 1878, the report was presented, adopted and published, and now constitutes one of the few really valuable documents issued from the government printing office.

Aids to Family Government; or, From the Cradle to the School, According to Froebel. By Bertha Meyer. New York: M. L. Holbrook & Co.

This is a translation into English of the most widely known and popular treatise upon the early training of children that has ever been published in Germany. Mrs. Meyer has not merely given Froebel's ideas, but, guided by the workings of Jean Paul Richter, she has popularized the ideas of child-life as presented by these great men, in a manner of which only a mother is capable. The book begins with advice in regard to the care of the body, then of the mind, then the methods of training, and kindergartens and home-life are discussed, while it concludes with Herbert Spencer's ideas respecting the true principles of family government, and ends with one hundred suggestions to parents, the last of which is, "What to do with the sons." Among other things it says: "Teach them the way to love nature and honorable work, to hate tobacco and strong drink, to love fruits and simple food, to spend their evenings at home," etc.

Buildings Erected from the Designs of Frederick Clarke Withers, Architect. New York: G. P. Putnam's Sons.

This is a beautiful collection of twenty-four designs, on a reduced scale, of prominent buildings which have been erected in various localities, after the drawings of Mr. Withers. Among those we recognize as having seen, we find with pleasure the design of the Jefferson Market Court House, with bell tower and prison, which, on account of its originality, has excited the most diversified opinions. We cannot help liking it, and earnestly hope that the adjoining market will be built according to the plan proposed in the last design of Mr. Withers, (as the re-building of the old structure has become necessary), fearing if it should fall into other hands, with other heads, it might be as bad an abortion as the recent extension to the New York Court House, which is most outrageously out of keeping with the rest of the building.

Proceedings of the Engineers' Club of Philadelphia. Edited by Charles E. Billin.

We welcome the first and second numbers of the above new publication, and wish the enterprise success. The most striking articles in the last number are "Conical Arches at South Street Bridge, Philadelphia," by D. M. N. Stauffer, C. E.; "The Holly System of Steam Heating," and "Compressed Air Motors for Street Cars," by Prof. L. M. Haupt. It is always a cheering sign when the proceedings of societies are found sufficiently interesting to deserve timely publication, and in this way to

produce in the course of time a series of volumes which will not only be a creditable record of work accomplished, but of incalculable value for future reference.

Useful Information Pertaining to the Generation and Use of Steam. By Babcock & Wilcox, Engineers; with Catalogue of their Manufactures. Published by the Authors, 30 Cortlandt street, New York.

Messrs. Babcock & Wilcox conceived the fortunate and sensible idea of incorporating into the catalogue of their manufactures, a variety of useful information not readily accessible in other ways. Those who obtain this valuable publication, while learning the character and quality of their steam engines and boilers, may also acquire facts and figures based on practical experience, and which therefore can be depended upon as reliable. Some of these facts and figures have been published before, but in a less practical form, while a great number are new. The various subjects treated are: "Horse-Power of Boilers," "Combustibles," "Economy of Fuel," "Incrustation and its Prevention," "Explosions of Boilers and their Prevention," "Feeding Boilers," "Covering Steam Pipes," "Heating and Drying by Steam," "Calorimetric Trials," "Tests of Boilers," etc. The paper and printing are excellent, as are also the illustrations.

The United States Official Postal Guide. Boston: Houghton, Osgood & Co., Publishers.

This publication for April is an unusually important number of this valuable periodical. In addition to the usual information regarding all matters pertaining to the details of the postal service, it contains the new Classification Act, approved March 3d, which makes so many important changes in rates, that every business man, and every person who uses the mails to any considerable extent, needs this authentic statement of the law. This number also gives the list of post offices, arranged alphabetically by states. The completeness and authoritative character of this postal guide makes it well-nigh indispensable to all who write letters to a foreign country, or send postal money orders, or make any more than the simplest use of the mails.

Notes and Queries.

This department is intended to furnish, for the benefit of all our readers, information on any subject of scientific or practical knowledge falling within the field of THE MANUFACTURER AND BUILDER. *All persons possessing additional or more correct information than that which we give relating to the questions, are cordially invited to communicate it to us for publication. We also request that all questions or answers be written on separate pieces of paper, and addressed to the Editor.*

QUESTIONS.

(2353) RELIABLE LIGHTNING RODS.—I intend to build a house and wish to protect it from lightning, but have no faith in the rods as put up by travelling peddlers—in fact, from the experience I have gained I am firmly convinced that these rods are positively dangerous to any house on which they are placed. My house will be irregular in shape, and the roof will be surmounted with an iron cresting. Around the highest flat part, covered with sheet metal, will be a cresting 24 inches in hight, and on the lower ridges it will be 18 inches high. Will it be necessary to connect this metal work with moist earth? or will I need elevated rods on the chimneys?—A. A. E., Battle Creek, Mich.

(2354) CONSUMPTION OF COAL IN ENGLAND.—What is the yearly consumption of coal in England? and how does it affect the atmosphere there?—G. N., Dixonville, Pa.

(2355) PRODUCTION OF MERCURY IN CALIFORNIA.—Does California continue to produce at present as much mercury as she has done heretofore? What is the quantity produced?—G. M., Burlington, Vt.

(2356) ELECTRO-PLATING WITH TIN.—Is there any method of tinning from a solution of tin? If so, please give it.—S. R. J., Cambridge, Mass.

(2257) POLISHING IRON.—What is the best method of giving iron a bright polish, like steel?—W. D., Carrick Furnace, Pa.

(2358) PROPORTIONS OF SMALL PROPELLERS.—What size of propeller would be about right for a fast pleasure boat 25 feet in length, with engine 5×6 inches? What size, pitch, and number of blades are best? Where is the best place to get it?—A SUBSCRIBER, * *

(2359) LIFE-TIME OF A LOCOMOTIVE.—How long on the average does a locomotive last?—R. K., Larned, Kans.

(2360) NUMBER OF LETTERS IN VARIOUS ALPHABETS.—What number of letters compose the alphabets of various languages? I know that Hebrew and Latin have four letters less than the English. How is it with other languages?—SCHOOL-TEACHER, Brooklyn, N. Y.

(2361) ALMANACS.—Can you inform me in what country the greatest number of almanacs are published?—S. J., Lenox, Pa.

(2362) FAMOUS ALMANACS.—I see that at auction sales, some old almanacs are sold at very high prices. Can you tell me what kind of almanacs bring high prices. I have a lot of old ones and would like to know which are valuable and which are only fit for waste paper.—S. J., Lexox, Pa.

(2363) WHERE TO GET MAGNETITE.—Please inform me where I can obtain magnetite in quantities, containing as little silica and lime as possible. If you have the analysis and the price, I would be pleased to have them.—E. G., New York City.

(2364) HARMLESS HAIR DYE.—1. Will you please tell me how to apply the hair dye mentioned on page 48 of your late February number, in answer to Query 2304. 2. Must the bottles in which it is sold be entirely covered over with paper, to exclude the light? 3. Can it be mixed in a room where there is daylight? 4. Of what is pyrogallic acid made?—H. E. W., Worcester, Mass.

(2365) RAISED LUSTROUS BLACK WRITING.—Please give me a recipe for making an intensely lustrous black ink, that will look raised on the paper when dry.—H. D. E., Oakland, Cal.

(2366) MISS HOSMER'S PROCESS FOR MAKING MARBLE.—Is it known what the process is by which Miss Hosmer, our American sculptress in Italy, makes marble.—SCULPTOR, New York City.

(2367) TAMPERING WITH THE CUT-OFF.—I have an engine, and I wish to lengthen the stroke of the cut-off. I am told that if I cut down the short side of the cam without adding to the large side, it will bring about the desired result—that is, to cut it down ¾ of an inch to lengthen the stroke ⅛ of an inch. I am not satisfied with this, and do not believe it can be done, but I may be wrong; if so, please inform me.—L. A. W., Mallet Creek, Ohio.

(2368) INJURIOUS SHOE-BLACKING.—Is the French liquid blacking injurious to leather? My shoemaker claims that it is. He says it shines the boots without labor, but ruins the leather. Please give your opinion.—W. P., New Brunswick, N. J.

(2369) CEMENT FOR IRON.—What is the best kind of putty to fill up holes in iron castings, water pipes, etc.?—H. K., New Bloomfield, Pa.

(2370) DISSOLVING METALS.—Can all the metals named on page 1422, Vol. II., of "Knight's American Mechanical Dictionary" be had in solution? Please give the acids that apply to each.—H. D. E., Oakland, Cal.

(2371) ACOUSTIC TELEPHONE.—Can you personally recommend the telephone advertised in your journal? Are there any cheap ones suitable for business purposes that are better?—J. S. C., Shelbina, Mo.

(2372) COMPOUND LUBRICATING OIL.—Would not pure lard oil, cut with kerosene or benzin, be better for use on sewing machines than sperm oil? If so, will you please give formula for preparing the same.—J. S. C., Shelbina, Mo.

(2373) MINERAL LUBRICATING OIL.—Is the refined rock oil for lubricating purposes in the market? If so, who has it for sale?—J. S. C., Shelbina, Mo.

(2374) ELEMENTARY BODIES.—What are the elementary bodies in general?—H. D. E., Oakland, Cal.

(2375) RUBBER CEMENT.—I made a thick cement for leather, by dissolving gutta percha in bisulphid of carbon. The leather was clean, but the cement would not hold satisfactorily. How can I make it very strong?—H. D. E., Oakland, Cal.

(2376) COST OF ALUMINUM.—Can aluminum be had any cheaper now? or is it as expensive as ever? Who is the principal manufacturer of it? Where can I buy it? I want it for alloys? How about its adaptation for coinage?—D. K., Troy, N. Y.

(2377) REMOVING GREASE AND PAINT SPOTS.—What is the best way to remove grease spots from clothes? also paint and varnish?—W. F., Sherman, TEX.

(2378) PROTECTING IRON AND STEEL FROM RUST.—What is the best substance to protect iron, such as coarse hardware, machinery, steel bars, etc., from rust?—C. O., Belfast, Me.

(2379) ELECTRO-BRONZE VARNISH.—Can you give any information about the bronze varnish which gives iron railings and posts the appearance of bronze? I think it is made in Philadelphia. Please give your opinion in regard to it.—F. J., Bethel, N. Y.

(2380) PETROLEUM-PRODUCING COUNTRIES.—Where is petroleum found besides Pennsylvania, West Virginia, Ohio, Massachusetts, Colorado, and California?—J. J., Black River, Wis.

REPLIES.

(2353) RELIABLE LIGHTNING RODS.—Your arrangement is positively dangerous, and will not be improved by elevated rods on the chimneys; on the contrary they may increase the danger, if you do not add the principal and most important part of any kind of lightning rod, namely, a thorough ground connection. Lightning discharges follow the laws of electricity, because they are electric phenomena on a gigantic scale, and they want a metallic path by which the lightning from a cloud can reach the moist earth. This path you may furnish by erecting at the side of your house a stout vertical iron bar, with its upper end connected to some part of the iron cresting and metallic roof, and its lower end reaching deep into the ground. The latter is the true lightning rod. If there is water, a swamp, a well, or very moist earth near your house, you must continue this bar under ground in that direction until it reaches any of these. If the lower end of the bar only reaches dry sandy soil there is not sufficient protection; such soil will not conduct lightning, but it may jump from the conducting rod through the wall of the building, so as to reach a better conductor inside, such as the pump standing over a well. We saw the effects of such a case at Germantown, near Philadelphia, where the lightning left the iron rod placed on the outside of the house, perforated the wall, played havoc with the kitchen utensils on its way to the pump, through which it found a better conducting way down into the earth than could be found outside, where the lower end of the rod was buried in the dry gravel to the depth of only two inches. The lightning rod on top of the house was very elaborate, with a gilded ball and many points around it. It had been put up by a patent lightning rod man, who evidently did not understand his business, and did everything for show, while that which was not seen—the thorough ground connection—did not exist. We refer you to pages 74 and 75 of our March number for 1870, where you will find an elaborate description of a good lightning rod, illustrated with an engraving. We will add that the rod running along the side of the house need not be isolated with glass rings, as some lightning rod men will try to make you believe necessary. Lightning is so powerful that such a glass ring is no protection against it. It will go through a wall; we have seen it pass through a closed window and break every pane of glass in it, while a window next to it was open. The cause of this was a stovepipe, which passed through the floors from below, while the stove stood on an iron plate, which, from its position, formed a good ground connection—in fact, the stovepipe was an upward projecting conductor from the earth, and its upper end being the nearest conducting point to the closed window the electricity was attracted by it, notwithstanding the little obstruction of the sashes with glass panes. High elevated pointed rods on the chimneys are not absolutely necessary, but may do some good by a continuous silent discharge of the atmospheric electricity, and thus diminish the violence of the strokes, or perhaps discharge a cloud altogether.

(2354) CONSUMPTION OF COAL IN ENGLAND.—It is estimated that 114,044,000 tons of coal are burned every year in England. As every pound of coal consumes 3 pounds of oxygen and produces 4 pounds of carbonic acid, the carbonic acid produced amounts to 228,088,000 tons; and if the coal contains only 1 per cent of sulphur, the sulphur burned amounts to 11,440,440 tons; as every pound of sulphur consumes 1 pound of oxygen and produces 2 pounds of sulphuric acid gas, the amount of this gas is 22,880,880 tons, which is thrown into the atmosphere, and must certainly affect it, especially when not carried off and upward by a fresh breeze.

(2355) PRODUCTION OF MERCURY IN CALIFORNIA.—The production of mercury is increasing. It is now 4,200,000 pounds per year. During the last sixteen years San Francisco exported 28,000,000 pounds, at a value of $14,000,000. The greatest production of the Alameda mines alone has been 23,000,000 pounds, but at present they produce from 8,000 to 10,000 pounds per day, and on an average nearly 2,000,000 pounds per year, as the mines are only worked from September to May—seven months—the summer heat being insupportable and the evaporation of the mercury at a high temperature very injurious to the workmen. The total product of mercury of all the rest of the world is less than that of California alone, being 2,800,000 pounds.

(2356) ELECTRO-PLATING WITH TIN.—We have already described the solution used to cover brass with a thin film of tin; this is used for tinning pins and other small articles, but not fit to deposit a heavy coating, such as is required for culinary purposes. To accomplish this the regular electro-plating battery is required, and it has been found that the best bath is composed of 8 part of protochlorid of tin, 16 of cream of tartar, and 2 of chlorid of tin. If the latter is used the tin coating is effected more rapidly, whereas when the bath is composed of protochlorid of tin and cream of tartar only, the tin coating is very white, but is not produced so rapidly. The ingredients should be dissolved in about 100 gallons of distilled water. The plates are first "pickled" in a suitable manner, then immersed in the solution, and allowed to remain for a longer or shorter time, according to the thickness of the deposit required. When in this bath the plates are connected by a wire with the positive end of the battery, while the negative end of the battery is connected with a piece of tin hung in the same bath. When the articles have been sufficiently coated, they are held over a fire in order to give the tin a lustrous appearance.

(2357) POLISHING IRON.—To do this well, it must be first surface hardened, so as to give it a steel surface, as iron is too soft to take a bright polish. Any of the methods we have heretofore published for this hardening will do, but the following is recommended for this especial operation: Take 1 ounce of blue vitriol, 1 of borax, 1 of prussiate of potash, 1 of charcoal, and ½ pint of of salt dissolved in hot water, to which add 1 gallon of linseed oil; mix well, bring your iron or steel to the proper heat, and cool in the solution. After this operation it is treated in the same way as steel is treated to give it a high polish.

(2358) PROPORTIONS OF SMALL PROPELLERS.—You must consider what size boiler it takes to furnish steam for a 5×6-inch engine. Evidently your boat of 25 feet in length, and say 5 to 8 feet beam, is not large enough to carry all that. A 4×6 engine, with its boiler, is the very largest you possibly could carry. The wheel is best 30 inches in diameter, 3½ feet pitch, and to have two blades. The best place to get it is at the New York Safety Steam Power Co., 30 Cortlandt street, New York.

(2359) LIFE-TIME OF A LOCOMOTIVE.—The iron horse does not last much longer than the horse of flesh and bones. The ordinary life of a locomotive is 30 years. Some of the smaller parts require renewal every 6 months; the boiler tubes last five years, and the crank axles six years; tires, boilers and fireboxes from six to seven years; the side frames, axles and other parts, thirty years. An important advantage is that a broken part can be repaired, and does not condemn the whole locomotive to the junk-shop, while when a horse breaks a leg the whole animal is only worth the flesh, fat and bones, and has to

go to the horse junk-shop, which in New York city is Barren Island, beyond the harbor.

(2360) Number of Letters in Various Alphabets.—The English and German languages contain 26 letters; French, 25; Greek, 24; Hebrew, Latin and Dutch, 22; Italian, 20. Most other languages contain more letters—the Spanish, 27; Arabic and Turkish, 28; Persian, 32; Russian, 35; Armenian, 38; Slavonic, 42; Sanscrit, 44; the Chinese radical characters number 214, while their compounds, representing the different words, are from 3,000 to 4,000 for common use, and about 8,000 for men studying science and art. All this is exclusive of sounds represented by dipthongs, double letters, accents, ligatures, and contractions.

(2361) Almanacs.—We believe France issues the greatest number. One French publisher announces 30 different almanacs for each year. The "Almanac de France" contains 1,000 pages. The Imperial Almanac is the common size. Many of these almanacs are statistical, some are astrological and necromantic, while most of them are humorous.

(2362) Famous Almanacs.—As a rule old almanacs are mere waste paper; there are very few which are worth anything, except such as have become great literary curiosities. They are: The almanac of Regiomontanus, in German and Latin, 1475–1506; the first almanac printed in England by Richard Pynson, 1497; Tyball's "Prognostications," 1533; "Almanac Liegeois," 1636; Lilly's "Ephemeris," 1644; "British Merlin," 1658; Moore's almanac, 1698; the first nautical almanac, 1767; "Connaissance des Temps, Paris," 1699; first edition of "Poor Richard's Almanac," by Benjamin Franklin, Philadelphia, 1732; first edition of the "Almanac de Gotha," with statistics of European governments, 1755; Chambers' "Book of Days," 1862.

(2363) Where to get Magnetite.—L. Feuchtwanger & Co., of 16 Dey street, New York, make it a business to keep and furnish various minerals. Address them.

(2364) Harmless Hair Dye.—1. First wash the hair, so as to remove all greasiness, which prevents the dye from acting; then rub it dry with a clean towel and apply the liquid, taking care to avoid touching the skin, as it may stain it slightly. 2. The bottles need not be as carefully covered as those containing nitrate of silver hair dyes, but it is best to exclude the light. 3. It can be mixed in the daytime, but do not allow the direct sunlight to shine on it, as the pyrogallic is sensitive to a strong light. 4. Pyrogallic acid is made from gallic acid, and this is extracted from gallnuts. To the above we add: 5. Do not dissolve pyrogallic acid until just before you are about to use it, as when it is dissolved it slowly decomposes, even in the dark.

(2365) Raised Lustrous Black Writing.—Dissolve equal quantities of sugar and gum arabic in water; evaporate to such a consistency that it will still flow from the pen and leave a raised line; then add a little anilin black, just enough to make it opaque, and write with it on strongly sized paper.

(2366) Miss Hosmer's Process for Making Marble.—It is reported that she makes the statue, or other object, first of common limestone, and then places it in a boiler furnished with a safety valve and pressure gauge, so that the pressure therein can be noted and controlled. The boiler is then filled with water, care being taken that there is no mineral deposit introduced with the water, and that the water completely covers the objects placed within the boiler. The boiler is then hermetically sealed, fire applied, and the water allowed to boil until the pressure gauge indicates 75 pounds atmospheric pressure if the objects are small, and 90 or 100 pounds if the objects are large. When the heat reaches these points, all are allowed to cool until the pressure returns to zero; the objects are then removed from the boiler, and placed in an alum or colored bath, various recipes being given for different colors.

(2367) Tampering with the Cut-Off.—There are various and peculiar cut-off arrangements, and hence it is impossible to answer your inquiry so that it will be sure to apply to your particular case, without seeing the engine, in which case the answer could be given in a few words. You had better show it to an expert engineer.

(2368) Injurious Shoe-Blacking.—We are perfectly satisfied that the contrary is the case. Most all paste shoe-blackings contain oil of vitriol, (sulphuric acid), and some of them also muriatic (hydrochloric) acid, which is very injurious to leather, causing it to crack, so that when boots are frequently blackened the uppers will not last any longer than the soles. The French liquid blacking contains nothing injurious, but is a sort of volatile black varnish, and therefore will not ruin leather, like the pasty acid blackings in tin boxes, which are now at a discount and sold quite cheap. We have given these two compositions a comparative trial, using each kind of blacking continually on the same pair of boots, and the result was as we expected—the boots blackened with the paste and brushed, cracked long before those on which only the French liquid was used showed any such defect.

(2369) Cement for Iron.—A good cement for this purpose may be made of equal parts of gum arabic, plaster of Paris, and iron filings, and if a little finely pulverized white glass be added to the mixture, it will make it still harder. This mixture forms a very hard cement which will resist the action of fire and water. It should be kept in its dry state and mixed with a little water when wanted for use. A cement for making joints in water and steam pipes, repairing leaks in iron water tanks, or in any work where two pieces of metal are joined together, and it is desirable to make a perfectly tight joint, may be made of iron filings or turnings mixed with sal-ammonia. The proportion of sal-ammonia is very small, only ½ pound being used to 50 pounds of filings. A similar recipe, which is perhaps still better, is to make a mixture of iron filings, sal-ammoniac, protoxid of lead, and sulphur; mix as a powder and keep dry until needed, when it is moisted to a paste with a little salt water. The cement, when mixed, is driven into the joint with a cold chisel or other tool.

(2370) Dissolving Metals.—If you mean by the expression "to be had in solution," whether you can buy them in solution, we answer, No; if you mean whether they can be dissolved, we answer, Yes. Nitric acid will dissolve most all metals except gold and the metals belonging to the platinum group, which are platinum, palladium, osmium, irridium, and rhodium. To dissolve these you must use aqua regia, which is made by mixing one part of nitric acid with two parts of hydrochloric acid. Silver does not dissolve in this, as chlorid of silver is formed, which is insoluble, so that for silver nitric acid is the best solvent. Copper and mercury also dissolve in this, and in hot sulphuric acid. Iron and zinc dissolve in cold and diluted sulphuric acid. Lead and copper dissolve in acetic acid. The solutions most useful for practical purposes, such as electroplating, are the cyanid solutions. To make them the general method is to dissolve the oxid of the metal in a solution of cyanid of potassium, by which a double salt is obtained, being the cyanid of the metal and of potassium. But different metals require different treatment, thus a solution to electroplate with zinc is best made by dissolving oxid of zinc (zinc white) in a solution of caustic soda.

(2371) Acoustic Telephone.—We cannot recommend the telephone referred to. We ordered one, supposing that it worked by electricity, generated by magnet and coil, but, to our great disappointment, it was nearly the same kind as those sold in the streets of New York for 10 cents, consisting of two tin cups with a piece of bladder stretched over them, and a hemp string attached to the center of the bladder. The difference is that in this telephone the cups are wood, for the bladder a piece of ferrotype-plate is used, and for the string a copper wire; the latter has to be kept well stretched between the two stations, and cannot well be used around corners without impeding its effectiveness. The principal defect is, that when the wind blows the stretched copper wire is set in vibration like an æolian harp, and so many sounds, howling, whistling, etc., are heard, that a conversation cannot be carried on through the instrument, as the voice is overpowered. You can obtain the materials for a regular telephone—magnets, coils, handles, etc.—and if cheapness is an object, you can make a tolerably good instrument yourself, provided you have some knowledge of electro-magnetism.

(2372) Compound Lubricating Oil.—Kerosene or benzin will not do any good, as they are too volatile and soon disappear. All that they do is to make the oil keep better in the store, as they prevent it from turning rancid. For this purpose the natural heavy petroleum is better, while the heavy thick kerosene which comes over at the end of the distillation of petroleum, is extensively used for this very purpose. There are plenty of such oils in the market, consisting of lard, sperm or fish oil, mixed with variable quantities of lubricating heavy petroleum, shale oil, (an oil distilled from bituminous shale), etc.

(2373) Mineral Lubricating Oil.—C. G. Miller & Co., of 136 Vine street, Cincinnati, O., deal in all kinds of mineral or rock oils. We refer you to their advertisement on 3d page of cover.

(2374) Elementary Bodies.—We are not sure that those we call elementary bodies are actually elements and not compounds, and this for the reason that we know a great many compounds that behave exactly like elements; thus, for instance, ammonia and cyanogen act chemically in all respect like elements, with the only difference that we can decompose them, while we cannot decompose potassium and sodium, which ammonia resembles; nor can we decompose chlorin and iodin, which cyanogen resembles. Therefore the definition of an elementary substance has been prudently so defined that we call elementary bodies all those which thus far we have not succeeded in decomposing into other substances.

(2375) Rubber Cement.—We are not surprised at your want of success as we have gone through the same experince in repairing rubber gas bags. The trouble with the bisulphid of carbon, if used for a rubber cement, is that it swells the rubber up very much, and then by evaporation it again shrinks, and by this shrinkage the cement becomes loose. You cannot do anything to make this kind of cement strong, at least we found it so and abandoned its use; in any case we found it far inferior to the turpentine and benzole cements. Rubber dissolved in turpentine makes a cement that will stick, but it does not dry very well. Rubber dissolved in benzole is the best cement. Do not use petroleum benzin, as this does not dissolve rubber, but take coal tar benzole; in this liquid, as well as in turpentine, fresh rubber must be thoroughly kneaded and heated, in order to cause it to dissolve.

(2376) Cost of Aluminum.—We are sorry to say that the expectations that this metal might in the course of time be produced cheaply, are not realized. The reason is that no cheap process has been discovered, and probably will not be. The ore is cheap enough, as it is simply clay. The best material from which to make it is perhaps the cryolite of Greenland, a fluorid of soda and alumina, and this is abundant and cheap. The only country where they make it pay to manufacture aluminum is in France; manufacturers in England and Germany cannot make it pay, and are giving it up, if they have not already done so. You can get it from H. Merlé & Co., in Paris, who now, with the Societé Anonyme de l'Aluminum, are the principal producers in France, and keep it in blocks, bars, wire, sheets and foil. The price varies from $13 per pound in blocks to $17 per pound in wire and sheets. Aluminum tablespoons can be had for $20 per dozen; teaspoons, from $4 to $5; and thimbles of pure aluminum for 25 cents each. We wish our government would stamp small coin out of aluminum bronze, which would be somewhat nearer to the value they represent. An alloy of 90 parts of aluminum and 10 of nickel would be worth about 4 times as much as nickel alone, and this should be used for the nickel 5-cent pieces, which are now mostly copper, and actually are only worth 1 cent; this is an inducement for unscrupulous persons to make them, which they can easily do just as well as the government, and with profit too. Copper and brass, or bronze cents, should be entirely abolished; they are actually worth scarcely one-fourth the value for which they pass; pieces like our 5-cent nickels should be stamped 1 cent, and others of aluminum of the same size should be stamped 5 cents. The use of iron for coin has long since passed, the use of copper coins is now ending, and what we want are coins of nickel for 1 and 2 cents, of aluminum for 5 and 10 cents, of silver for 10, 25, 50 cents and $1, of platinum for $1, $2 and $5, and of gold for $5, $10 and $20; this is what is needed in accordance with the present state of the metallurgical market. As the silver dollar of 412½ grains has been adopted by the United States as the standard of value, platinum and gold coins might go at a premium or discount, according to the relative market value of the metals; gold is at a premium now, or soon will be, and if our government persists in trying to keep it down to the ratio of 16½ of that of silver, so as to make it agree with the ratio of our gold and silver coins, they will attempt a thing they cannot do, and end by driving the gold out of the country.

(2377) Removing Grease and Paint Spots.—The treatment varies according to the material; white linen can stand alkaline lyes, while cotton, especially when colored, does not stand it so well, and wool or silk not at all. To take grease spots out of linen, cotton or wool, first try soapsuds; if these do not take them out perfectly, you may use a potash or soda lye for linens; for wool it is best to use ammonia or strong soapsuds, mixed with ammonia. If the grease spots are produced by the drippings of a stearin candle, which often happens, use strong alcohol; this is also good for silk; but ordinary grease cannot be taken out with alcohol; it is necessary to use ether or benzin, and in any case to rub carefully with a clean rag, so as to remove the dissolved grease. Do not (as we have often noticed some persons do) merely pour some benzin on the grease spot and let it dry up; if you do not rub it out the whole operation is of no use. Silk requires great care, as also does paper, and it requires some experience to become an expert. One method, especially adapted for removing grease spots from light colored silks and valuable papers, is to cover the spot with pulverized magnesia, chalk, fuller's earth, or pipe clay; lay a paper over it and then press with a hot iron; the heat will liquefy the grease and the powder will very readily absorb it. The yolk of an egg and ox bile are also recommended for silk, and soap also when used with care. In regard to varnishes, they are usually soluble either in turpentine or strong alcohol of 95°, and more easily removed than some oil paints. The most obstinate of the latter is zinc white, which, in combination with linseed oil, forms a hard white crust, which, as it resists most the above-mentioned solvents, is very difficult to dissolve out when it has penetrated into the texture, and especially when the material is woollen cloth.

(2378) Protecting Iron and Steel from Rust.—Iron and steel goods of all descriptions can be kept free from rust by the following: Dissolve ½ ounce of camphor in 1 pound of lard, take off the scum, and mix as much black lead with the mixture as will give it an iron color. Iron, steel, and machinery of all kinds, rubbed over with this preparation and left on for 24 hours, and then rubbed with a linen cloth, will keep clean for months. If the machinery is for exportation, it should be kept thickly coated with this during the voyage.

(2379) Electro-Bronze Varnish.—The Philadelphia Smelting Company have a patent by which they put a coating upon iron that is claimed to make the articles as good as real bronze. This however we doubt, as it is only a thin coating, which cannot adhere very strongly or last very long, for the following reason: The articles are first dipped into paraffin, so as to arrest further oxidation, and then coated with fine graphite to form a conducting surface, after which they are put into a bath containing a mixture of the solutions of the salts of the two metals which constitute bronze—copper and tin. That this treatment does not make the articles equivalent to bronze, is proved by the fact that they are coated with a varnish which they call a peculiar protecting one, and therefore a proof that it is by no means as good as real bronze, which does not need varnishing.

(2380) Petroleum-Producing Countries.—In the first place, in Ontaria, Canada; next Germany, Austria, Italy, Russia, Peru and Japan. In these countries petroleum is as abundant as with us; but the enterprise of the people has not developed the production and its refinement as we have, consequently we are now furnishing the world with the refined article.

THE MANUFACTURER AND BUILDER.

Vol. XI.—No. 6. JUNE, 1879. ELEVENTH YEAR.

Testing Scale for Finding the Strength of Materials.

The increase in the variety of applications of various building materials, makes it more and more necessary to obtain a precise knowledge of their strength—that is, it is absolutely necessary for the architect and engineer to know what the limit is that the material can stand before it breaks, or is crushed by the upper incumbent weight.

The machine here represented is intended for this purpose; while the strain or pressure can be increased by a series of screws and levers, the amount of pressure can be measured in pounds in a way similar to that used in platform scales. The pressure is produced by the turning of the hand-wheel seen below in the center; this causes the beam to rise, when, by an arrangement of clock-work, the poise is moved to a point on the beam indicating the number of pounds strain or pressure on the specimen. When this point is reached, the beam drops and the poise remains at the point where it is when the beam commences to fall. If more strain is then applied, the beam again rises and the poise moves on as before, and so on, until the specimen is crushed or broken, when the figures on the beam at which the poise stops indicate the exact number of pounds strain or pressure at which the specimen gave way. The parts of the apparatus shown in Fig. 1 are arranged so that not only pressure but tension may be applied to any specimen under examination. The ingenious arrangement by which the poise is made to advance when the beam rises, and to stop when the beam falls, is shown in Fig. 2, in which A is the rod connecting the beam with the multiplying levers; B is a sliding poise, which, in the use of the machine, is set to a point that, in the judgment of the operator, approximates nearly to, but does not exceed, the measurement of the stress desired to be applied to the material under examination. When this is done, and the stress is applied to the substance to be tested, the beam will rise; in so doing, the lever C engages a stop at D; this lever being pivoted at E, its inner end will be made to rise by its engagement with D, and in so doing the rack teeth formed on the inner arm of the lever C are made to disengage from one of the toothed wheels of a train of clock-work; the weight F then begins to descend, and being connected by a cord with the clock-work, and through that to the poise G, the latter is made to pass out towards the end of the beam. The clock-work is attached to the end of the beam itself, and vibrates with it; the office of the clock-work is simply to retard the motion of the weight, so that it shall run down slowly, and move the parts G slowly toward the end of the beam. To this end the clock-work drives a fly H, similar to the fly used to retard the motion of the striking weight in common clock-work. As soon as the bar begins to descend the lever C, which is counterpoised on its inner end, drops by its own weight, and stopping the clock-work, leaves the poise G where it is at the time the beam begins to descend. Unfortunately the designer of the adjoined engraving (Fig. 1) has omitted to represent the specimen of material while being submitted to the the test.

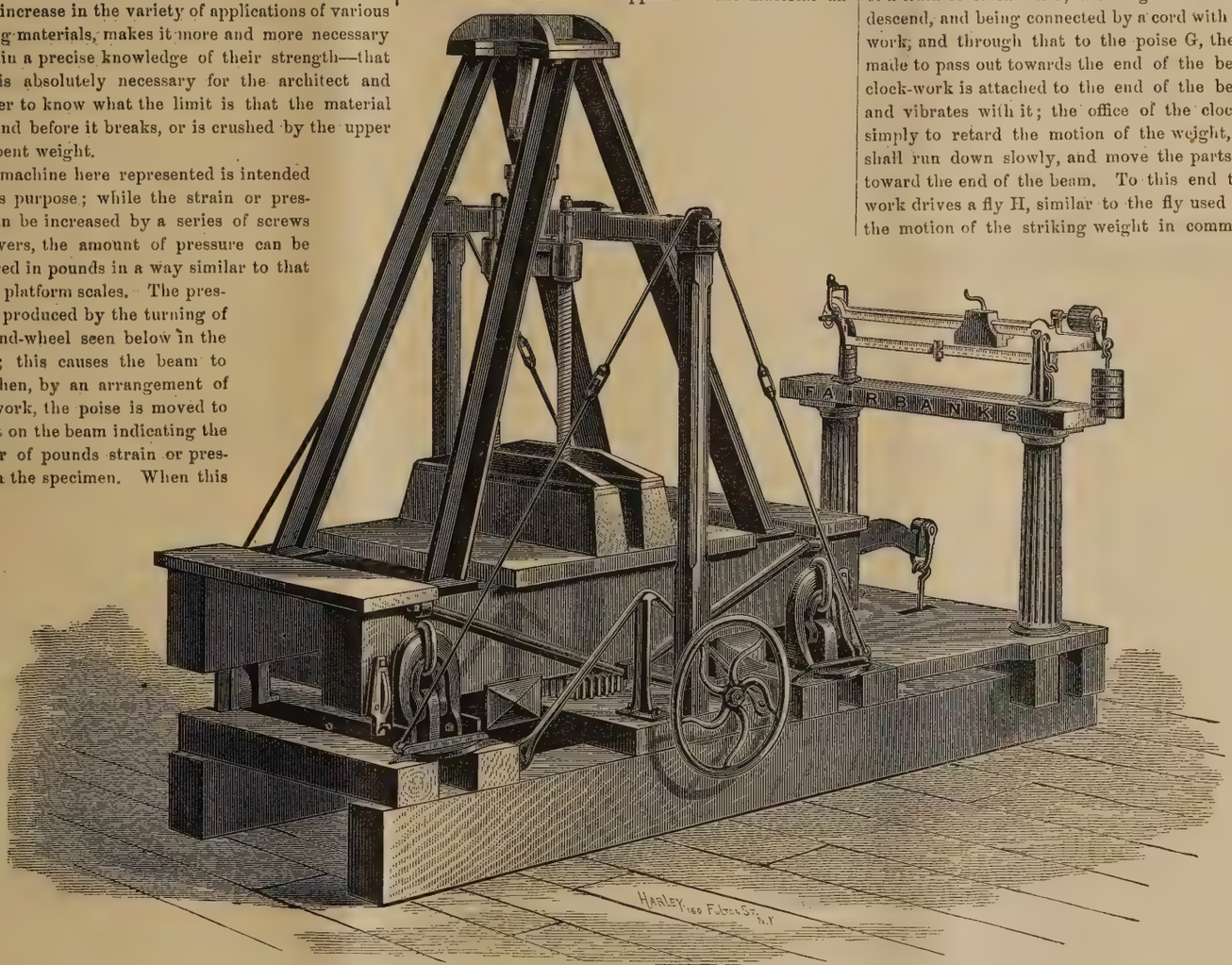


Fig. 1.—FAIRBANKS' SCALE FOR TESTING THE STRENGTH OF MATERIALS.

Fig. 2.—Details of the Weighing Beam.

An important improvement in regard to holding the specimen to be tested ought to be mentioned. Heretofore it has been customary to form the keys or wedges for holding the specimen with flat or square surfaces, and hence it has always been necessary to have the faces of the specimen square or perfectly parallel, in order to secure a uniform grip on the specimen. Specimens, however, such as boiler plates, so often vary

in thickness that the opposite sides are not exactly parallel, and the grip becomes firmer on one side than the other. Under these circumstances a serious difficulty is very often experienced, as the specimen tears diagonally, commencing on the side which is held firmest, and thus prevents a satisfactory test. In the newly patented wedges this difficulty is overcome by forming the back of the wedge or the face of the wedge seat, convex or curved, the wedge being narrower than the seat, so that the wedge of itself is adjusted at once to a firm bearing on the specimen, an advantage that will be obvious at once.

Messrs. Fairbanks & Co. also furnish with this machine a new device for indicating the extent to which a bar or rod will yield under tension before, or at the time, it is torn apart. They will be pleased to give particulars in regard to this useful invention on application to their office, at 311 Broadway, New York.

They have made some of these machines for public institutions, including Columbia College of New York, and the Stevens Institute of Hoboken, also for the United States government, etc., and their perfection has added to the reputation earned by this firm in the manufacture of their excellent platform scales. The results obtained by these machines have proved perfectly reliable and very useful.

The Manufacturer and Builder.

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This journal has the largest circulation of any mechanical monthly published in the United States. Its value as an advertising medium is therefore apparent.

Vol. XI. No. 6. ELEVENTH YEAR.

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The Intended New York International Exhibition.

There are now two parties who take a lively interest in the realization of a universal exhibition in New York city in 1883 or 1884. They are respectively the National Board of Trade, who have met at the Windsor Hotel from time to time, and the Executive Committee, whose rendezvous is the house of Judge Hilton. Both bodies are actuated by the sincerest motives, although they appear to be working at cross-purposes, and so nothing will be finally determined upon by either independent of the other.

The Executive Committee have expressed an opinion that the fair must be held somewhere on Manhattan Island, without determining whether the island is the most advantageous spot for the site of the buildings. There are many considerations to be weighed in choosing a place, and the National Board of Trade has found very serious objections to Manhattan Island, which the Executive Committee also recognize. Many sites have been offered, among them the Eastside Lands of Brooklyn. Some of the sites outside of Manhattan Island promise far better accommodations than any locality in it, and it is highly probable that the Board will select one of them.

It is contemplated to place the exhibition under the patronage of the United States, but without rendering the government liable in any way for the undertaking. A loan of $1,500,000, without interest, is to be asked for as soon as the proposed corporation shall have disbursed a similar amount. This corporation will consist of the shareholders in the enterprise. The capital is to consist of $10,000,000, divided into $10 shares.

In regard to the time for holding the exhibition, it is the opinion of Mr. McCormick, late United States Commissioner at the Paris exhibition, that the year 1886 will be quite as soon as it can be held with credit and success. If Germany should decide to have an exhibition in 1885, it will not necessarily interfere with holding one in this country the following year; it might, indeed, prove advantageous in affording an opportunity for foreign exhibitors to transfer their goods directly from Berlin to New York. Mr. McCormick also thinks that the site of the exhibition should not be in Central Park, not only because of the serious interference with the legitimate uses of the park, and the fact that it would require ten years to restore the parts occupied by the exhibition buildings, to their former condition, but because the park is by no means the best place for such buildings. A great desideratum is a river front, where heavy pieces of machinery and bulky goods can be unloaded directly from the vessels, and reloaded, thereby avoiding extra handling and terminal charges, which are usually high and very objectionable to exhibitors. Much delay and expense in the customs examination of goods from foreign countries would be avoided if the vessels bringing and returning them could go directly to the exhibition grounds, where the building should be made a bonded warehouse, and thus any examination of the goods rendered unnecessary, except in cases of removal beyond the limits of the exhibition. Moreover, a water front and landing upon the East and North rivers would be a great accommodation to visitors who might come in steamers from many parts of New York, New Jersey, and New England. To those persons who could spend but a day at the exhibition, it would undoubtedly be a relief to escape the delay, cost, and inconvenience of passing through the city.

The administration of the exhibition should be entrusted to a very small commission, with absolute power—say a commission of five eminently practical men of established executive ability, who, however willing and able to serve without recompense, should be well paid, and made to understand that while upon the commission their time and attention must be given to the business of the exhibition to the exclusion of all other interests.

At least three years should be allowed for the construction of the buildings and adornment of the grounds, and the public should be informed of the rules and regulations governing the exhibition, some time before the opening day.

Congressional action will be necessary to secure the attention of foreign governments, and this should be obtained as early as possible, not only that proper notice may be given to all countries, and ample time allowed for preparation, but also that the year chosen may not be appropriated for an exhibition by any other nation. The exhibition grounds should be high, dry, and picturesque, and they should be so extensive that there would be no limit to space for such special buildings as the foreign visitors or our own people may desire to erect. The jurors should be selected, and their names given to the public, at least one year prior to the opening of the exhibition, so that exhibitors may know who are to pass judgment upon their contributions. The jurors should be required to serve not less than three months, and should be liberally compensated, as experience proves that rarely ever are such severe duties faithfully performed without proper compensation for time and labor spent.

We think that the parties who at present are interesting themselves in our intended international exhibition, ought to be thankful to Mr. McCormick for his free expressions of opinion, which certainly, considering the position occupied by him, and the consequent weight of his words, are worthy of serious consideration, and of more importance than what any one else may suggest or publish.

New American Industries.

The recent rapid increase in American chemical manufactures—in many cases from native crude materials—is a very encouraging feature of American trade. The *Grocer* notes that six years ago we imported from France cream of tartar to the extent of 9,000,000 pounds yearly; but so successfully has the manufacture of it in this country been carried on, that last year not a single pound was imported. Notwithstanding the crude materials have at present to be imported, the price of the manufactured article has been reduced from 32 cents per pound, the rate for the French article, to 23 and 24 cents per pound for the American production. France and England formerly sent us annually 500,000 pounds of tartaric acid, while the importation for the last fiscal year was 183 pounds. England formerly monopolized our market for nitric acid to the extent of 250,000 pounds annually, at the rate of $1.30 per pound, while last year 27,018 pounds were imported and sold at the same price as the American article—57 cents per pound. At present the lime juice from which citric acid is made has to be imported, but it could easily be produced from fruits grown in Florida, if only sufficient energy were put into the work. If the lemon and lime growers of the South can be induced to prepare the lime juice, the entire production and manufacture of citric acid will be kept in this country, saving hundreds of thousands of dollars annually, and developing another great industry. Borax was formerly brought from England at the rate of from 600,000 to 1,000,000 pounds every year. Owing to the development of borax mines in Nevada, this importation has largely fallen off, and the report for the last fiscal year showed only 3,492 pounds, and the price of the refined article, which is now prepared in New York city, is only from 8 to 9 cents per pound, when formerly it was 35 cents, England being now among the buyers instead of the principal seller, as she once was, both of the crude and refined product.

Scientific Detection of Frauds.

We were recently called upon to investigate a document, which related to the appointment of a sea captain to the command of a vessel, at the rate of £35 sterling a month, for the balance of which amount, with interest and costs, the captain sued the ship owners. The latter claimed that in the original document £15 were mentioned, and that it had been changed to £35. Part of the document was torn and looked as if it had been partially burned, which was explained by the captain stating that it had been thrown into the fire by mistake; at the instant it was discovered what document it was, it had been snatched just in time from the devouring element.

We submitted the document to a microscopic, and,

as far as was safe, a chemical investigation, and found that the brown color was not that produced by scorching paper by fire, but was simply put upon the surface, and was nothing but tobacco juice. This evidently had been applied with the intention of more effectually concealing the change made. A close inspection also revealed where the paper had been scratched, so as to erase some letters, and that the ink with which the change had been made differed in shade from the ink with which the document had been originally written, the ink used for the alteration being darker. It was also detected that most of the letters of the original writing had been retouched with this darker ink, so as to make the document look more uniform. The statement of all this before the jury, and the verification by them, when explained how and where to look for details of the facts stated, settled the matter, and the captain did not get the $5,000 he claimed as balance of salary, with interest, costs, and damages.

A few years ago we were called upon to testify as to damages done by sea-water to part of a ship's cargo, which had been insured, while the insurance company refused to pay, under the plea that the damage had not been done by sea-water, but by rain or some other fresh water, not entering through the hull of the vessel, which was claimed to be tight. Nothing was easier than to settle such a point. A small portion of the damaged goods was soaked in distilled water, the analysis of which then proved that it had dissolved all the salts always present in sea-water, and that consequently the damage had been done by sea-water and not by fresh water. A simple certificate to this effect was sufficient to settle the matter, and the insurance company paid the damages.

Another and more recent case was that of an emery wheel which had been guaranteed to stand 600 revolutions per minute, and which burst while being driven at 1,000 revolutions, doing much mischief. The owner sued the seller to recover damages, and produced a letter from him stating that the wheel was guaranteed to stand 1,600 revolutions. The defendant applied to a chemist, suggesting that if it could be proved that the figure 1 of the 1,600 had been written with a different kind of ink than that used for the rest of the letter, the fraudulent alteration, which he claimed to have been practiced, would be proven. The chemist found out that there were in reality two different kinds of ink—that fortunately the ink used by the defendant contained carbon, which was not affected by oxalic acid, while the ink used by the claimant was an iron ink, which was affected by the acid. He applied this test in the presence of the jury, and removed the interpolated 1, while the acid left the rest of the ink as it was. So the forgery was proved, and the plaintiff had to bear the consequences of his imprudence in running the wheel too fast and his dishonesty in forging, and had to defend himself against a criminal charge.

The Bright Condition of Trade.

The *New York Times* in a very full report on the condition of trade in various sections of the country finds a very encouraging state of affairs prevailing.

The report embodies the views of correspondents from about 75 different points, in 31 States, nearly all the important centers of trade and manufacturing industries being represented.

In New England, manufacturers of all kinds appear to have felt the revival of business most strongly. Lumber mills are busy, but prices are low. Jobbers report a good spring trade. Sales are rapid, but on a small margin of profit. Retailers alone complain, being the last to feel the evidences of returning prosperity. Less idle men are to be seen on the streets, owing to factory resumption and emigration, and skilled labor is in demand. Wages are lower.

What has been said of New England is true of the Middle States. New manufactories are being started in some places, low wages rendering possible the running of the works on a lower scale of profits.

From Baltimore, which has lost much of its Southern trade comes a cry of distress, mingled with some self-congratulation over an increased export trade. Taking the other and South-western States, the general expression is very cheerful. South Carolina only reporting trade dull.

Throughout the West the same evidences of prosperity are shown, but are more self-asserting than in the South. No failures or rumors of failures in trade; collections easy. All the manufactories are busy. Those which supply materials and tools for farmers and new settlers are particularly favored with orders. Building is going on rapidly everywhere. Emigration is very large—some of the more Western States even appear to feel crowded. There is plenty of work everywhere for muscle and capital.

Sugar Production and Consumption.

The figures given in an article entitled "The World's Sugar Production," which is going the rounds of the newspapers, and which we reproduced on page 3 of our recent January number, are far below the reality. We remarked at that time that the statistics there given were too low, as they were 24 years old, and that the world had certainly progressed during that period, first, in population, but still more in productive capacity, and we closed the article by saying: "If the reader increases all the figures 25 per cent, he will certainly be nearer the truth."

We have now been furnished with statistics of the present day, and they show that the ratio of increase in the consumption of sugar per head of population has really increased about 25 per cent, but that the production has increased 100 per cent—actually doubled, which fact, we must confess, far exceeds our expectations. The production of cane sugar has increased in Brazil from 150,000,000 to 400,000,000 pounds; in the British colonies, from 440,000,000 to 600,000,000; in the Dutch colonies, from 160,000,000 to 400,000,000 for Java alone. The beet root sugar in France, from 360,000,000 to 900,000,000; the same in Germany, from 550,000,000 to 700,000,000; in Russia, from 100,000,000 to 500,000,000 pounds; and all the other producers in proportion. The amount of cane sugar produced in all countries is now 5,000,000,000 pounds, and of beet root sugar 2,800,000,000; grand total of raw sugar produced in the whole world, 7,800,000,000 pounds—more than double that produced 25 years ago.

Of this sugar New York city refines 19,000 barrels per day; the other cities of the United States, 11,000, making a total of 30,000 barrels, which amounts to almost 10,000,000 barrels (of 280 pounds each) per year, consisting of more than one-quarter of the whole sugar production of the world. This last fact gives the best illustration of the immensity of the sugar interest in the United States.

The consumption per head has risen from 33 to 42 pounds in the United States.

The Woodruff Expedition Abandoned.

This expedition, which has been before the public for over a year in vain attempts to make it a success, has at last wholly and finally collapsed. The reasons are that there has been an almost total want of support, and in addition an almost total failure on the part of those who promised to come forward at the proper time with their subscriptions. There were several serious drawbacks to the expedition, which will satisfactorily account for the want of patronage. First, the expense; the fare for the round trip was fixed at $2,500; this, in itself, was enough to bar the larger class of people, and left the expedition to be patronized almost wholly by the sons of the very rich. Second, the practical light in which the cost of such an expedition would compare with the same amount of money expended on education at home. The facts bear out the assumption that the average person of means, who alone could afford such expenditure, is not blind to the fact that pleasure and work, sight-seeing and study, are not wholly compatible with each other, and that he hesitates at the possible danger of sending his sons so far away, exposing them to the dangers of the ocean, and removing them from all restraining influence except the untried discipline of a floating faculty. The expedition has already cost no little time and money, and its projectors will undoubtedly lose heavily.

Humbug No. 2—Gary's.

It appears that Mr. Gary has for a long time been dabbling, experimentally, with steel magnets. Very unfortunately for him, he neglected to investigate what others had done, before he set out to make new discoveries for himself, and the result was that he rediscovered some old observations, and, giving them an erroneous interpretation, he came to the conclusion that he had made a new discovery. His imaginary neutral field led him to the conclusion that he would finally succeed in producing motion by magnetic attraction, and in this firm belief, as soon as he had a machine which was *almost* perpetual motion, he announced that he had found it, made some people believe so, got, by some hook or crook, a description full of false pretenses of the affair in *Harpers' Monthly*, and in this way the subject was brought to the attention of men who were competent to judge in regard to the matter, and they of course declared it a humbug, as in our present state of knowledge we know positively that a man who pretends that he can do work without any transformation of energy—in other words, obtain power out of nothing, is as much a humbug as a man who pretends that he can actually produce eggs from an empty bag. Now the latter thing has been done, and hundreds have seen it, but they know it is done by what are called legerdemain tricks. It is the same with the Gary motor; those who have seen it go, may be sure that it operates on the same principle.

Our opinion in regard to Mr. Gary, above expressed, was formed immediately after we read the account of his invention, or pretended discovery, without seeing his machine. We have recently been informed that Mr. Gary showed his machine to the late Prof. Henry, who, after listening patiently to Gary's explanations, said: "My dear friend, buy $50 worth of books, and study up magnetism before you waste any more time experimenting."

The personal friends of Mr. Gary appear to labor under the impression that his discovery is not credited because he does not belong to the "ring" of scientific professors—that if it had come from Profs. Henry or John W. Draper, it would have been heralded all over the world as an important contribution to science. We can assure those who are of that opinion that this would by no means be the case. If the great scientists named had announced this thing as one of their new discoveries, the whole scientific world would have lamented the fact that such eminent men had become crazy, as it would be impossible for them to advance such ideas without having become insane. We do not maintain that Mr. Gary is insane, because a man of his caliber may advance the most absurd ideas from sheer ignorance, which ideas, when uttered by a man of knowledge, could only proceed from the loss of his intellect.

To any one familiar with the phenomena presented by the attraction of magnetized steel bars and horseshoes, there is nothing whatever new in Gary's experiments, except in those which do not work, and cannot be made to work, his pictures notwithstanding. It is easy enough to picture a machine and to say it goes, but it is a different thing to bring the machine itself forward and demonstrate it by actual motion. This Mr. Gary has failed to do; months ago it was announced at the Polytechnic Club of the American Institute, which meets every Thursday evening at the Cooper Union, that Mr. Gary would come to exhibit his machine; but it appears that he labors under the same difficulty as all other searchers after perpetual motion—the machine is ready, or almost ready, and it goes—or rather, almost goes; only a little trifling improvement is needed, to demonstrate that the inventor is not a fool. Well, we will see.

Gally's Autophone.

Attempts to produce music in an automatic way are old, and have been more or less successful; but thus far they have been unsatisfactory, except in cases where very complicated, expensive, and cumbrous machines were constructed, such as the orchestrion, which is like a colossal hand-organ, operated by clock-work, costing hundreds and even thousands of dollars, and taking up considerable room, all of which places it within the reach of very few, while every piece to be played requires a separate, elaborate roller, which alone costs more than the whole instrument which we are about to describe. The principal merit of this is that the piece to be played upon it consists of a rolled-up strip of perforated paper, 3¾ inches wide and 20 or more inches in length, costing no more than is paid in stores for the sheet music which it represents.

It was a happy idea of Prof. Merritt Gally, of New York city, thus to condense the most essential part which produces the various musical effects. Attempts have lately been made in this direction to produce music by running a sheet of perforated paper over the openings of the reed-board of an organ, and thus let wind and sound escape from such openings as were permitted by the perforations; but this system is, by its very nature, crude and imperfect, and labors under inherent difficulties which are insurmountable from the very nature of the principle applied.

The merits of Prof. Gally's invention are manifold, especially when compared with such contrivances as those just mentioned. In the first place, the little bulk of the paper roll, which is small enough to put in the pocket; second, his instrument has a number of stops, with any kind of sets of reeds or pipes; third, these stops, as well as the usual swell, can be worked by perforations in the paper; fourth, the principle of this invention can be applied to any keyed instrument, whether it be a reed organ, pipe organ, piano-forte, or even church organ. It is evident that the perforations in the paper can be made so elaborate that two hands can not play them, not to speak of the manipulation of the stops, for which a player often needs assistance, so that even the full effect of a duet for four hands, with the assistance of a stop manipulator—in fact, the labor of three trained musicians, can be concentrated in this little strip of paper; it must be confessed that we have here the most successful invasion of musical execution by exceedingly simple and cheap contrivances.

The mechanism, which is operated by the music sheet for the stops, is as sensitive and rapid in its action as that for the note keys, rendering it possible to produce an unlimited variety of "expressions."

Fig. 1 represents a cabinet organ to which the invention is applied. The lady at the organ is placing into its bearings the small spool containing the strip of perforated paper which is to produce the music. The mechanism by which this sheet operates is connected with the ordinary pedals of the instrument, and therefore requires no skill except to operate the bellows. To give the reader an accurate idea of the dimensions of this sheet, and the punctures, notes, stops, and "expressions," we show the spool partially unwound, full size, in Fig. 2, representing the entire range of notes, six stops, and the "expression" devices. The size of the perforations, as will be seen, are exceeding small, but sufficiently large for the perfect operation of the instrument. The mechanism is operated pneumatically, but these small openings in the sheet are not for the passage of air to the pipes or reeds of the instrument for producing the sound. The air passing through these small punctures simply trips sensitive devices that operate the valves, which, in manual performing, are operated by the ordinary finger keys. The lines of punctures in the edges of the sheet represent the stops and "expression" devices. The air through these punctures operates the stops by

GALLY'S AUTOPHONE—A NEW AUTOMATIC MUSICAL INSTRUMENT.

means of a similar mechanism to that which opens the valves to the reeds or pipes.

Although the music with its "expression" is prepared according to the rendering of the best artists, the instrument is not limited to this or any set "expression" for the piece to be performed. For those without musical skill the "expression" prepared in the music sheet enables them to produce perfect music without requiring instruction or practice. The instrument, however, is not limited to the "expression" prepared in the music sheet, but affords to the accomplished musician the widest scope for the exercise of his or her personal taste and skill, the stops being absolutely under the control of the performer, so that the "expression" may be varied at pleasure. This is done with greater facility than by any ordinary arrangement of stops, being controlled by sensitive keys. Four of these finger keys are represented in Figs. 1 and 3, each side of the receptacle of the punctured strip in connection with button stops.

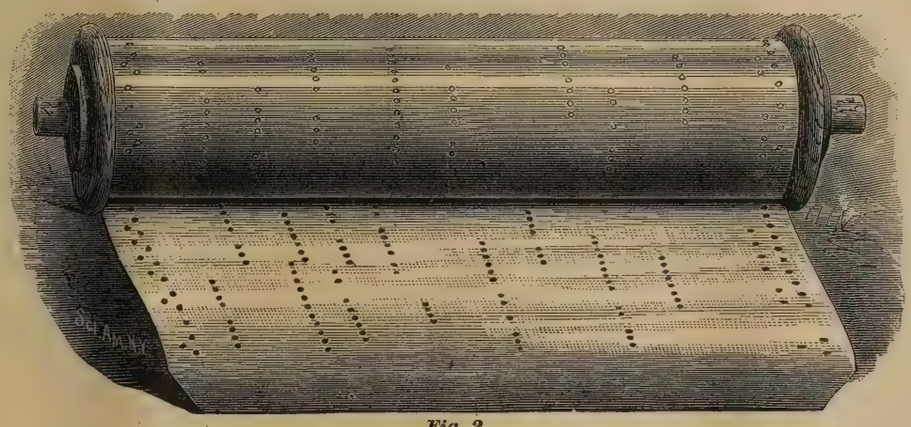


Fig. 2.

In Fig. 4 one of the finger keys and its corresponding button stop is represented full size. Turning the button with the lettered portion toward the operator accomplishes the same result as drawing an ordinary stop, or turning the lettered portion at right angles, (as shown in the engraving), accomplishes the same result as pushing in an ordinary stop.

The sheet or strip of music is marked at its head with the number of button stops which should be turned on before starting the mechanism. These stops, although turned on, are operative only when perforations in the edges of the sheet occur which indicate their action. Wherever these punctures do occur, even for a note or a part of a note, or an entire passage, the effect of the stop is produced. Thus far it will be seen that the effect of the stops is limited to the set expression indicated by the punctures of the sheet. The variety which may be given in the expression to accord with the judgment or taste of the performer differing from that represented in the music strip, is produced in the following manner: By the use of the finger keys A B, Fig. 4, the performer at will renders inoperative any of the stops represented in the sheet, and substitutes others at pleasure. The key is double-acting, arranged to be depressed at either end; depressed at B renders inoperative the stop that would otherwise come into action; any stop that is turned off and not to come into action, is thrown into action for the time desired by the pressure of the key at A. If the performer does not wish to use any of the stops indicated in the music strip, all the button stops are turned off before commencing the piece, and by pressing on the different keys at A, any variety of expression is given.

For example, a single note which for the best effect is to be begun softly, and would on an ordinary instrument be increased by the swell only, is in this instrument increased not only by the swell, but by an accumulation of stops commencing, if necessary, with only a single stop, and ending, if desirable, with an accumulation of ten.

Although the time in which the music is written, is, by the mechanical motion, strictly adhered to, nevertheless, to avoid mechanical appearance in the rendering of the music, and to divest it of every feature that might be in the least objectionable, or that in any way might fail to realize the most perfect conception of the artist, the instrument is provided with an ingenious mechanical device, by means of which the time may be instantly changed, accelerated, or retarded through any passage, note, or part of a note, or a "hold" made on a note, at the will of the performer, especially adapting the invention for rendering accompaniment for singing. The first key to the left of the receptacle for the sheet (see figure) operates a mechanism for retarding the movement of the sheet to allow sufficient interval for a passage, producing a "hold" or a perfect rest, which is not indicated in the arrangement punctured in the strip.

To repeat a passage or part of a passage not arranged in the sheet to be repeated as ordinarily performed, and to enable the operator to repeat any part at will, once or successively, without limitation, the key just described, in connection with the draw-knob at the right of the receptacle, recalls for repetition any desired part of the music-strip; the return being instantly made to pre-arranged limits, only so much of the strip being drawn as is desirable. The convenience of this device in singing, or in playing dance music, will be seen at once, as comparatively short strips answer the purpose as well or even better than very long ones, besides lessening their cost.

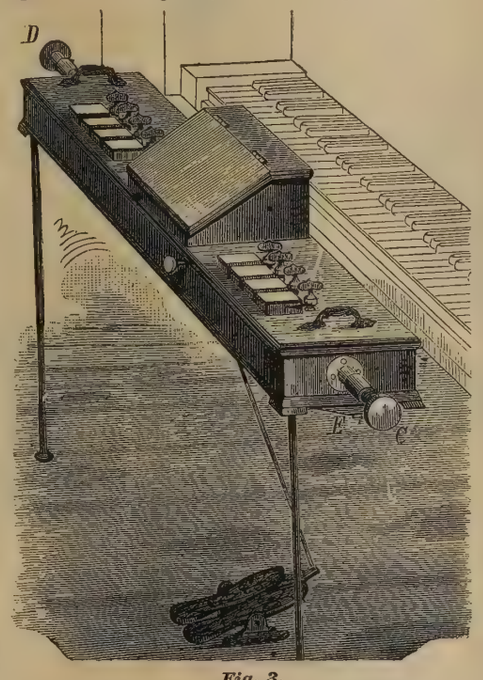


Fig. 3.

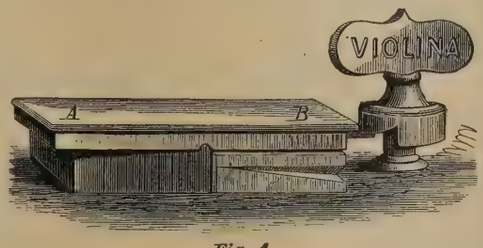


Fig. 4.

The instrument may be arranged for any number of octaves; the music strip, however, need not necessarily be increased beyond the width already mentioned.

The autophone is not only adapted to organ music, but is equally well adapted to the piano. The "expression" produced upon the organ by the operation of the stops, in connection with the music sheet, is produced in a similar way upon the piano, the soft and loud pedals not only being acted upon on the music sheet, but the variety of touch required for the best effects is fully attained.

The autophone seems destined to prove invaluable in its application to orchestrions; the small, cheap music sheet accomplishing all, and even more, than the very expensive barrels of such instruments. The addition of variety in expression which this invention will impart to orchestrions, and which they have not heretofore possessed, will, it is claimed, increase their value.

The narrowness of the sheet, and the fact that it is not necessarily thick and cumbersome, but is light and cheap, are important qualifications. This music, we are informed, will be sold as cheaply as ordinary sheet music. It is made by machinery especially designed for this purpose, while by reason of the smallness of the perforations, the paper is left strong and durable.

The autophone is adapted to instruments having a key board that may at pleasure be used for manual performance, as shown in Fig. 1; or it may form a part of an instrument not having finger keys, for use by those who are not musicians, and who do not desire the addition of the ordinary key board to the instrument. It is also made as an attachment to perform upon organs or pianos already in use, and may be readily placed upon or removed from the instrument.

The invention is represented in this form in Fig. 3, in which the ordinary key board of an instrument is shown, the attachment being moved toward it to be placed over the keys. If the instrument be a wind instrument, as an organ, the connecting rod, shown as attached to the foot pedals, is connected to the ordinary pedals of the organ, the pedals shown being when the attachment is employed to perform upon a piano. This invention, when applied to the piano, as when applied to the organ, is not limited to the set "expression" of the music sheets.

C D represent padded binding screws, which take hold of the uprights of the instrument at each end of the key board, to hold the attachment firmly in position. A line of strikers, corresponding and striking upon the keys, are operated by mechanism similar to that already mentioned. Connections are also made from the attachments with the ordinary stops and "expression" devices of the instrument, and are operated by the punctures of the sheet or other finger stop keys, as heretofore explained. One of the strikers is shown at E projecting under the attachment. The rod supports shown are movable. In the form shown the attachment is light and portable, and may be easily carried by hand. When not desirable to have this portable a case is provided supported by castors.

To recapitulate, the autophone is constructed on purely scientific principles, and is as simple as it is wonderful, requiring no adjustment, and always ready for action. Its mechanism is so perfect and its operation so free, that it is not liable to get out of order, and, with ordinary care, will last for an indefinite period. It is, in all essential respects, unlike anything heretofore invented, either in structure, action or musical results.

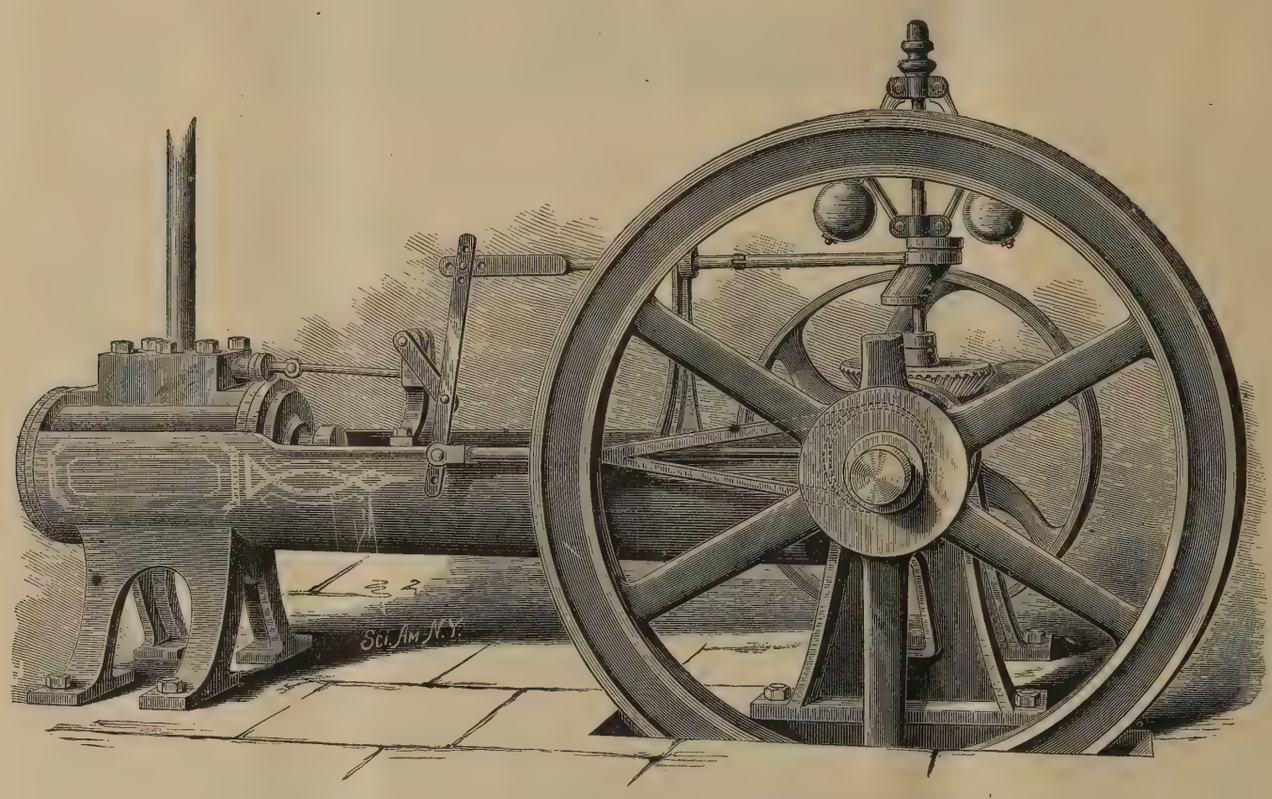
Prof. Gally has for several years distinguished himself as the inventor of what is known as the Universal Printing Press. We refer all those interested in the account we have given, to his office, No. 9 Spruce street, New York city.

A New Cut-Off for Steam Engines.

Mr. George H. Cobb, of Palmer, Mass., has invented and recently patented a single slide valve, operated by the joint action of two eccentrics, one of which is secured to the main shaft, while the other moves freely up and down on the shaft of the governor, but is prevented from turning thereon by the slot in the eccentric and a feather on the shaft. The eccentric is graduated, so that its center varies in position at every point in its width, and, being movable, passes around from one side of the shaft to the other. It is acted upon by the governor, which varies its position according to the speed of the engine.

Around each eccentric is a strap, and the two straps are connected by means of a link or lever, which has its fulcrum on the lever that operates the sliding valve, while the governor takes its motion from the main shaft, through a miter gearing.

The adjoined engraving shows these details plainly; the governor balls are seen behind the upper part of the fly-wheel; immediately under them, on the axis around which they turn, is the sliding eccentric or cam, seen in its position as an oblique cylinder, with the strap around its upper part. When, by rapid rotation, the governor balls are raised, they allow the oblique cam to ascend, when the strap will embrace its lower portion, and of course modify the motion of the upper rod, and the upper end of the vertical lever, seen at the left of the fly-wheel; with the other lower end of this lever the ordinary eccentric is connected, which eccentric and its surrounding strap is indicated by dotted lines around the main shaft, as seen near the center of the fly-wheel.



COBB'S IMPROVED CUT-OFF.

The matter of adjustment of the cut-off in relation to the speed of the engine is very simple and easy, the whole of it depending only on the relative lengths of the governor arms with the movable eccentric.

One great advantage of this device is that it can be applied to engines already in use, and any one who is satisfied that his engine could be run with greater economy of fuel, or with the development of greater power for the amount of fuel used, should not delay to apply so simple an arrangement, which in a short time will certainly repay the expense involved by it.

Address Mr. George H. Cobb, Palmer, Mass., who is prepared to make arrangements for the introduction of this invention, by disposing of part interest, or otherwise. He will be glad to communicate with any one wishing to open negotiations, and will cheerfully give any particulars desired, not here stated, in regard to the invention.

INVENTING.—Inventing to-day, says the *Iron Age*, can be classed among the exact sciences. It is no longer a matter of happy accident, or even sound mechanical judgment. The world has progressed rapidly during the last thirty years, and to-day we find that the merely ingenious man can do but little that is of value to the world; in other words, something more than ingenuity is necessary to the production of a successful invention. Thirty years ago a good mechanic could hardly spend an hour in a shop without seeing an opportunity for improvement in something, and at that time what was true in one shop was true everywhere. Since then a whole generation has been steadily at work improving and inventing; mere ingenuity has exhausted its powers, and even originality has but a limited field in which to seek profit in inventing. The first task of the inventor now is to discover a want; he must then find out whether any attempts have been made to meet this want; if so, how, when, and by whom; in other words, he must learn the state of the art, so that he may avoid traversing the footsteps of others who have failed. These are not matters which can be guessed at; they call for careful study, and when he has learned all he can about the subject, he is ready to attack the problem intelligently—not before.

Use of Glass Thread.

To make fine glass thread, the glass is brought to a state of fusion, a glass rod dipped in it, and thus a thread pulled out, which solidifies first in its thinnest parts, and so causes a thread of uniform thickness to be obtained. If this thread is placed over a hot metallic cylinder, and the latter revolved, any length of thread may be obtained; the thread may be obtained finer by revolving the cylinder more rapidly. The heating of the cylinder has the effect of annealing the glass to some extent, while the rapid cooling, if wound on a cold cylinder, would make it more brittle. A bundle of such threads look like a bunch of silk, and it has therefore been called glass silk. Its usefulness to chemists and druggists has lately been brought to the notice of the French Société de Pharmacie by M. Limousin. It is now largely used in Germany, and especially in Austria, for filtering liquids in laboratories. In the microscope the threads are as fine as those of silk or fibrillæ of cotton; they break more easily than the latter, but are excessively supple. From the unalterability of the substance it is very well suited for filtering acid or alkaline solutions, even concentrated, and various other substances, such as nitrate of silver, albumen, collodion, Fehling's liquor, etc. It affords great rapidity of flow, with good filtration; it does not, like filters of paper or tissue, communicate organic matters to the liquids, altering and perhaps giving them a disagreeable taste. It is much preferable to asbestos, which, from the arrangement of its parallel fibers, cannot be formed into a flexible ball, and which lets fragments pass that float in the liquid. For analysis it is very advantageous, allowing of a ready determination of insoluble matters deposited; also by calcination and fusion of the glass may be found the volatile principles fixed in the passage of the liquid, unmixed with empyreumatic products. Notwithstanding the price of glass silk is still high, it is no great expense to use it, as its excessive lightness admits of a considerable number of filtrations being made with a small weight of it; besides, it may serve an indefinite time, if after each operation it is thoroughly washed with water and dried in the air.

THE LENGTH OF DAYS.—At London, England, and Bremen, Prussia, the longest day has 16½ hours. At Stockholm, in Sweden, the longest day has 18½ hours. At Hamburg in Germany, and Dantzic in Russia, the longest day is 18 hours and the shortest 7. At St. Petersburg in Russia, and Tobolsk in Siberia, the longest day has 19 hours and the shortest 5½. At Tornea in Finland, the longest day has 24 hours and the shortest ½. At Wardbuys in Norway, the longest day lasts from the 21st of May to the 22d of July without interruption; and at Spitzbergen the longest day is three months and a half. At New York the longest day has 15 hours 56 minutes; and at Montreal 16½ hours.

Transmission of Power by Chains.

Of all the attempts to use chains for the transmission of power, the Ewart detachable drive chain has been the most successful. One form is represented in Fig. 1; there are many other forms, but we have not space to represent them here. They are all covered by pat-

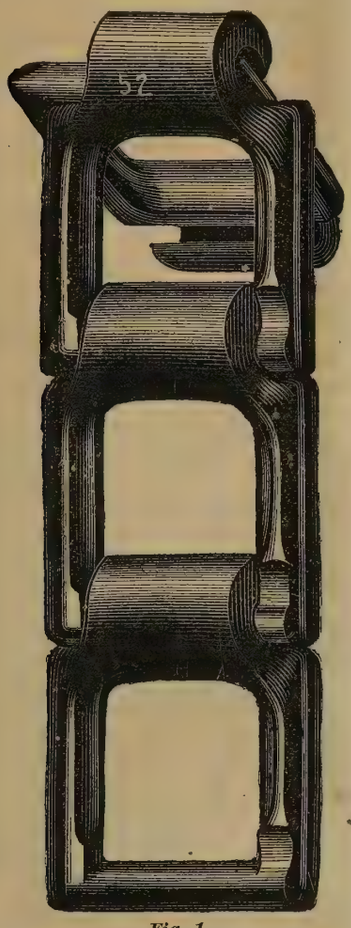


Fig. 1.

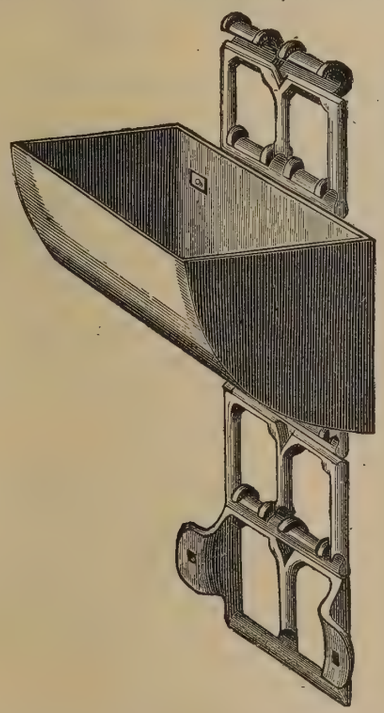
ents, which are owned by the Ewart Manufacturing Co., who manufacture them of the very best quality of malleable iron, and subject every link to inspection. The links are put together to make any length desired, and before shipping are tested in full lengths with a machine especially designed for the purpose.

The particular advantage claimed for this chain, is that it is not affected by the action of the weather, heat, cold, rain, chemicals, nor when running in water, as is the case with leather belting, which, under such circumstances, is soon destroyed. Another advantage is that it cannot slip, therefore it is of undoubted value in cases where positive and exact motion is necessary, and in vertical or inclined transmissions, and it may run so loosely on the wheels that a link may be readily taken out and replaced without removing the chain. It is largely used with malleable iron buckets in elevating phosphates, chemicals, and ores; for these uses it may be tinned or galvanized to prevent rust. It may be, and is, used on various machines, among which are harvesters, mowers, reapers, binders, headers, corn shellers, corn planters, windmills, middlings purifiers, threshers, cotton gins, governors, portable forges, pumps, water motors, drills, trimmers, live rolls, carriers and conveyers of all kinds; ice, grain, offal, shot, water, and tan-bark elevators; for traction engines, transmission of power in all classes of machinery, and in numerous other cases too numerous to mention, of which we will only describe a few, showing the importance of the application of Ewart's chain belt.

One is the straw carrier, of which a section is represented in Fig. 2; two chains, one at each side, are connected by cross bars, which move the straw forward on an upward inclined plane as rapidly as necessary, and pile it up beyond the most elevated end of the incline. Extensive farmers and dealers in fodder will at once see the advantage in cases where large quantities of straw have to be rapidly disposed of. Another application of far more importance is in saw mills, especially in regions where they are operated on a very extensive scale—for instance, in the timber regions of Michigan, Wisconsin, and Minnesota, we should say that the employment of this chain belt is indispensable. Besides securing the positive motion referred to, as well for the movement of the saw as for the carrying of the lumber while being worked; even for feeding light stuff to the saws feed chains are used to secure a regular parallel motion, and a smooth, even sawcut. Then, for conveying the sawdust away, the chains are applied to elevator boxes. The dust coming from the saws, the finest parts of which are used for firing the steam boilers, passes through the grated floor on the lower chain, through which it is sifted; all the coarse pieces and bark that do not go through this sifting process are carried to the end and delivered into a receptacle, from which they are dumped into carts, while the fine sawdust sifted through falls on an inclined or perpendicular elevator, carrying it to an iron trough over the boiler; the trough is regularly fed by means of a V-shaped spout, provided with a slide to regulate the supply, according to the wants. These troughs are provided with a sheet-iron damper and counter-weight, so that when the chain, dragging through the trough, delivers sufficient dust into the spout to overbalance a counterpoise, the damper drops and delivers its load into the fire, closing again, so that the draft may not be obstructed by the slides or the top. The engineer, who regulates the supply, causes the surplus dust to be delivered outside; in this way firemen and shovellers are entirely dispensed with.

These sawdust carriers are made of wood, of such a size as to fit one large link of the chain; the best size is 2 feet wide over all, or 20 inches in the clear. The chain links and boxes are connected together by a screw-bolt and nut, as seen in the engraving. Lumbermen of the Northwest have not been tardy in endorsing these contrivances and introducing them extensively, and acknowledging their superior merits.

A large stock of links of different styles and sizes is carried by the manufacturers, and orders receive prompt attention. Wheels of nearly any desired diameter are furnished to suit the chain, at short notice.



Inquiries should be accompanied by a statement of speed desired to be run and purpose to which they are to be applied.

Mr. E. T. Copeland, of 30 Cortlandt street, New York, gives special attention to this article, and has applied it extensively as a substitute for belts and gearing. Through his agency it has found many new uses. Upon request sample links will be sent to any address, without charge or expense.

The Eastern Lumber Market.—The Boston *Commercial Bulletin* takes a very discouraging view of the Eastern lumber market. It says: "Lumber is one of the few great staples that show no signs whatever of a

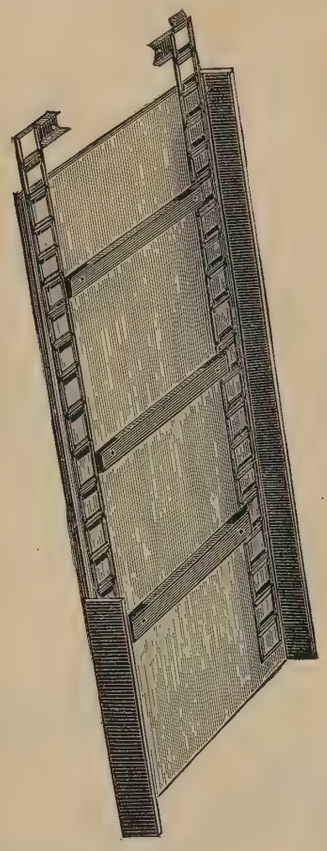


Fig. 2.

reaction. The market seems to be as depressed as at any time since the panic. In the vicinity of Boston but little building is going on, and in the city itself the number of building permits of late has been even smaller than at this time a year ago. The cut of logs in Maine last winter was smaller than that of the previous year, but in the West it was much larger, owing to the favorable snows; and lumber from that section will be received here in larger quantities than ever this summer. Already the receipts have been very heavy."

The Prospects of Cotton.

Mr. Edward Atkinson, one of the shrewdest business men in New England, has lately made a trip through the cotton States to investigate the prospects of cotton culture in the South. The results of his investigation have been given in the New York *Herald*. Touching the main point of his inquiry, he says:

"I consider an ample supply of cotton as sure, or even more sure than that of any other crop. So long as the cotton States can buy from the West corn and bacon at such prices that 40 cents will pay for all that an adult laborer can eat in a week—about 3½ to 4 pounds of bacon and a peck of meal—the South will raise cotton; it is their money crop. It is now the product of the farm and not of the plantation; the farmers of northern Georgia make a hundred bales of cotton where they only made ten a few years ago, and the increase of the staple by white labor in Georgia, North Carolina, and Texas will offset any possible decrease in Louisiana and Mississippi, even if the exodus amounts to a severe drain on labor. Moreover, the value of the seed of cotton has hardly begun to be known. Within ten years the seed will be worth half as much as the bale, if not fully as much. The lint left on the hull by the gin is useful for batting; the hull

for tanning or for the extraction of dyestuffs; the spent hull for paper stock, for which it is admirable; the kernel first for oil, and residue for feed. There are new methods lately discovered for extracting every particle of oil, which leaves the residuum sweet, dry, and extremely nutritious for food for sheep or cattle—more nutritious than beans; and if the residue be fed to sheep on the cotton field the crop of cotton will be doubled and the clip of wool added thereto."

Building Intelligence.

NEW YORK CITY BUILDING ITEMS.

The new armory of the Seventh Regiment is to be finished by next November. The building occupies the whole quadrangle between Fourth and Lexington avenues and Sixty-sixth and Sixty-seventh streets. It is 400 feet in length and 300 feet in breadth. The armory is divided into two parts—the Administration building and the drill room. The first takes 100 off the Fourth avenue end of the armory. This part, which is separated from the drill room by a wall only, is 100 feet by 200, and is three stories high. In this the hallway, the lateral corridors and the staircases are very spacious, and is an undivided space, elliptical in shape, and immense wrought-iron trusses, eleven in number, span it from side to side and support the roof. The bricks forming the interior walls will be simply smoothed and painted. Two galleries will be set in the west wall adjoining the Administration building, and seats will be placed on the floor about the edges of room, between the girders, sufficient to accommodate 800 persons. Beneath the drill room, on the south side, a rifle range has been excavated, consisting of two brick archways, thirteen feet wide each, and 400 feet in length. The whole building has the form of a parallelogram. There are four square towers on the corners, and a central tower rises above the main entrance on Fourth avenue. The building is constructed of Philadelphia brick and granite. The whole cost will be about $350,000.

A new building to replace Nos. 14, 16 and 18 Wall street, with the L extending to No. 3 Nassau street, is to be erected by Frederick W. Stevens. It is to cost about $200,000, and will be built after designs prepared by George E. Harney, and will have a frontage of 69 feet on Wall street and run back 122 feet. The Nassau street extension has 24 feet front and 27 feet depth. The design will be as near to pure Queen Anne architecture as Mr. Harney thought it prudent to go. The material is Baltimore face-brick, with a liberal use of Belleville stone. There are five stories, with another story in the Mansard. No color except that of the material is used, and even in the window heads, where the glazing is done in very small squares, plain plate-glass will be used. The general front has a strong central section running up to an extreme hight of 100 feet. The main cornice is but 73 feet above the street line. To the upper line of the curb roof the distance is 91 feet, but the central portion of the design having a Dutch step gable rises the 100 feet. On either side above the third story are turned large brick arches over openings 15 feet wide. These openings run through two stories and are broken on the third floor level by a broad stone transom, while stone shafts acting as mullions divide the windows from each other. The four spandrils are filled with terra cotta work—employed only here and in brick color. Above the two large arches runs a belt course or sub-cornice in Belleville stone surmounted by stories with low-arched openings. The dormers are brought out broadly and boldly in stone with curious little pediments over the central window of each trio. The first story is finished entirely in rubbed stone work and despite the temptations to fanciful carving the egg and dart molding is the most elaborate used. Iron is used only in a pair of window mullions on the first floor. There are two entrances, both flanked by stone pillars supporting the characteristic scroll pediment. The entrance nearest Broadway gives access to the ground floor and the first floor, the offices running back to the extreme rear. Thus the main offices may be rented and entered independently of the upper part of the building, to which there is a door at the eastern corner, a hallway leading to the inner angle, where are the stairs and elevators. The well, which is left open to the ceiling of the first floor, lights every office above by direct open-air windows. The Nassau street front will follow the central section of the Wall street front, but will have six stories, the uppermost for the janitor. The first and second floors will be tiled and finished in gray and white marble wainscot in common with the halls and passages in all parts of the building. The offices will be furnished in ash. The heating will be by indirect radiation and every room will have as well an open fire-place. The division walls throughout will be of brick, the Mansard roof will have an iron frame, and the stairways will be in iron. The lining of the interior 18x45 foot court will be of white enamelled brick, securing a strong and permanent reflection of light from top to bottom.

A committee will soon report on the site and the plans for a new building which the Hebrew Orphan Asylum needs. A new building is to be erected also for the Home for Aged and Infirm Hebrews.

CHICAGO, ILL.

The Illinois Central Railroad Company are putting up a new depot on Van Buren street.

There is to be built on Hermitage avenue, near Jackson street, a school-house for the Rev. Thomas D. Cashman, to cost $4,500. It is to be 26 by 45 feet, three stories. Eagan & Hill, architects.

Ground has been broken for a grain elevator at the intersection of Morgan street and the South Branch of the Chicago River. The main building is 101 by 386 feet, and is 136 feet high to the apex of the roof. The engine room and boiler house is 35 by 76 feet, and the chimney is 150 feet high, with a 4 by 6 feet flue. The main building will be inclosed in corrugated iron and will contain 26 elevators. The bins will be 55 feet high, and have a capacity of 2,000,000 bushels. The structure will use about 2,000,000 brick (common), 50,000 ft. of dimension stone, and 6,000,000 ft. of lumber. The piles for the foundations are being driven. It will be completed in October. Cost, $300,000. Armour, Dole & Co. are the owners, and E. Bauman, the architect.

There is to be built, at the corner of Randolph and State streets, a large block, with stores on the ground floor, and a grand music hall above. The style of architecture is simple and of a massive character. The main entrance will be from State street into a vestibule 17 feet wide, which ends in a flight of six marble steps, rising to the level of the floor of the auditorium. There will be six stores fronting on State street, each 17 feet wide by 60 feet deep, and five stores fronting on Randolph street. The southern portion of the sixth floor will be occupied as a rehearsal hall, with parlors, dressing-rooms, and secretary's room. The Randolph and State streets corner will fitted up as an art gallery and photographic studio. Mr. Adler is the architect.

ST. LOUIS, MO.

Peabody & Stearns, of Boston, are the architects of a building for an art museum for the Washington University. It is to be the gift of Hon. Wayman Crow.

Taylor & Barnett, architects, are to build for Moffet & Chouteau a four-story building 230 by 140 feet. The fronts will be of iron and Warrensburg stone. The building is to be well protected against fire. It will cost about $200,000. The contract for the iron-work has been awarded to Snead & Co., of Louisville, Ky. Work on the excavation has just begun.

MISCELLANEOUS.

The Methodist Episcopals are commencing to build an $8,000 house of worship at Cobourg, Canada.

Seventy-five thousand dollars have been voted by Lorain county to build a court-house at Elyria, Ohio.

The rebuilding of Chace's Thread Mills at Fall River, Mass., recently burned, will be pushed forward with energy this spring.

J. R. Thomas, architect, of Rochester, is building at Canandaigua, N. Y., a new brick church on Main street.

The building committee of the Barron Memorial Church, at Dexter, Maine, has adopted plans submitted by Henry Dexter, of Dexter, and the church will be built after designs furnished by him.

A large hall is in course of construction at Willoughby, Ohio. It is three stories in hight, of brick and stone, 84 x 42 feet in size. Cost $12,000. Walter Blythe, architect, Cleveland, O.

A Methodist church is to be built at New London, Ohio, from plans prepared by Coburn & Barnum, architects, Cleveland, O. It is cruciform in plan. Of brick, with stone finish. Cost, $7,500. 75 by 70 in size.

Saratoga is to have a new and elegant opera house this season, at the northeast corner of the Grand Union block, and a large skating rink on the Hathorn Spring grounds. A recent bad flavor in Congress water has been found to proceed from the running of surface water into the spring, and the cause of the trouble has been removed.

The contract has been awarded to Benjamin F. Walton, for the building of ten three-story press-brick-front houses, on the corner of Clinton avenue and Wall street in Trenton, N. J., for Joseph McPherson, Whitehall Stokes, and O. C. Bowman. The contract price is $20,840. J. H. Whittaker, of that city, is the architect and superintendent.

A church is to be built on the corner of Tulpehocken and Adams streets, Germantown, Philadelphia, from a design by Mr. James P. Sims, architect. Mr. A. H. Williams is the contractor. The old buildings on the ground are now being torn down to make room for the new. Trenton stone, with Ohio stone finish, are to be used for the walls. The roof is to be of slate, and panelled on the inside up to the tie beams, the trusses showing. The contract price is $22,600.

At a meeting of the Board of Directors of the Corn and Flour Exchange, in Baltimore, Md., it was resolved to erect a new building for the accommodation of the Exchange. A committee was appointed to select a site for the building. The association has now on hand the sum of $62,000 with which to carry on the work. The plans and specifications of the building have not yet been prepared. It is hoped to purchase the site and prepare the building plans, etc., in time to commence work during the coming summer.

R. Snowden Andrews, of Baltimore, is the architect for the West Virginia Hospital for the Insane at Weston, W. Va. His plans, however, were adopted twenty years ago, and he has had little to do with the building since. The hospital when completed will be 1,260 feet in length, 860 feet of which is built. The section which is now to be built will be 215 feet long. The entire building is of cut stone, and, including 300 acres of ground, out-buildings, etc., will, when completed, have cost about $1,000,000. The legislature has appropriated $95,000 to build the next section. It is located twenty-three miles from the Baltimore and Ohio Railroad, and at the terminus of a narrow-gauge railroad running from Clarksburg to Weston. T. B. Camden, M. D., is the superintendent.

The new post-office at St. John, N. B., will cost about $100,000. It is 90 by 40 feet on plan, with three street-fronts. It will be three stories in hight above Prince William street, with two basements (already built) below that level. The floors throughout are to be fire-proof; deep iron girders 48 feet in length will be placed across the building at intervals, and on these will be laid rolled iron joists supporting brick arches. The spandrils of the arches will be filled in with concrete, and on this, furring to receive the flooring boards will be laid. The façades are designed in the Italian style, but will be somewhat plainer than is usual with the works of this class erected by the Dominion Government. Mr. Stead is the architect, under the direction of Mr. T. S. Scott, Chief Architect of the Department of Public Works, at Ottawa.

Improved Portable Engine.

The requisites of a portable engine are efficiency, safety, simplicity, durability, and to be easy of transportation. The engine represented in our engraving fulfills these requisites, and perhaps another very important one nowadays—it is comparatively very cheap. The latter quality has not been obtained by employing inferior material or workmanship, but by a thorough system of manufacture, aided by special machinery, confining the production to a few sizes only, and devoting close attention to the working parts; the result is what has become known as the Bookwalter engine.

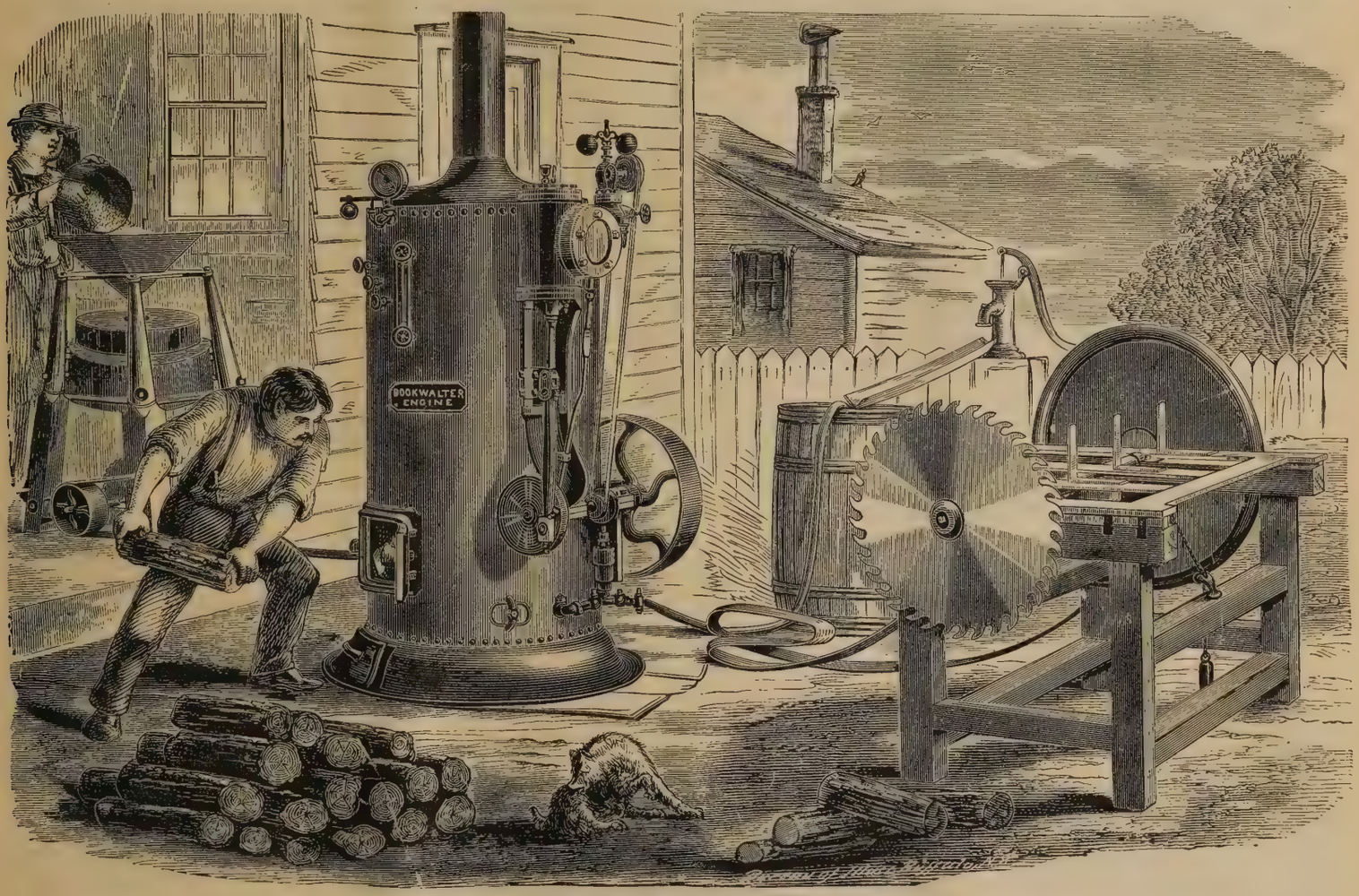
The boiler is an upright tubular, a form which takes up little room, is light and strong, and at the same time economical and safe, as the weak point of other such boilers, which is leakage at the crown sheet, has been overcome in this one, being entirely free from leakage at that point. The engine, bed-plate, pump, governor, etc., are constructed and attached to the boiler in the most simple and firm manner, so that the heat from the boiler does not, by expansion, change the relation of the working parts to each other, while all working parts, including grates, bed plate, door and bonnet to the boiler, are made in duplicate, so that in case of breakage the owner can get a new part and replace it without having to go to a machine shop with the engine.

Every boiler and engine is tested by hydraulic pressure to over twice the working pressure, and also steamed up and run, before leaving the works, to insure its perfect working in the hands of the purchaser. The boiler and engine leave the works complete, just as represented in our engraving. The price is $215 for 3 horse-power, $245 for 4½, and $315 for 6½ horse-power; this includes boiler, engine, force pump, steam gauge, grate bars, gauge cocks, safety valve, glass water gauge, steam valve, governor, blow-off cocks, etc.

This engine has now been in the market for six years, and in that time earned its share of appreciation, and a large number have been sold, especially for farm work, or, as represented in our illustration, for driving a wood saw and corn mill. It fulfills a great want felt at present for a cheap, plain, substantial, durable and easily managed engine, in contrast to many expensive, stylish, and complicated contrivances now in the market. Its cheapness, combined with its other qualities, has undoubtedly been the main cause of its success, evident from the fact that these engines have replaced scores of others, have been used for all kinds of work, and have made a good record.

In regard to safety, the manufacturers refer to customers who have been ginning cotton, grinding corn, sawing wood, threshing wheat, etc., with them for several years. Not a single Bookwalter boiler has ever exploded or hurt any one, and in fact we have yet to learn of a single instance where the fire flues burnt out and became defective. Certainly few engine builders who have hundreds in use can show a better record.

The manufacturers of these engines, Messrs. James Leffel & Co., of Springfield, Ohio, allow a thirty days' trial, and guarantee success. They have a branch office at 110 Liberty street, New York.



PORTABLE STEAM ENGINE.

Revival of the Iron Business.

In the year 1873 the amount of American iron and steel production had reached a point higher than ever before, but the succeeding depression in all branches of business decreased the demand for iron and steel to such a degree as to cause the failure of many works. We are now however pleased to state that during the last few years the demand has so largely increased as to encourage production, and this to such an extent that the production of 1878 surpassed that of 1873; we have, therefore, just passed a year in which more iron and steel was produced than ever before in the United States.

This was not expected, as in 1878 the number of blast furnaces in operation was much less than in 1873, while many rolling mills were idle; but it appears that this was made up for by the larger amount produced by those that were in active operation. The production of iron decreased since 1873 to 1878, from 1,837,000 tons to 1,556,000 tons; but that of steel increased from 223,000 tons to 820,000 tons; total, 2,060,000 tons in 1873 against 2,376,000 in 1878.

The indications are that the production for 1879 will be still greater, and it is a cheering sign that at a time when every other country is experiencing a contraction in business, we are expanding; it is a proof of the recuperative power of the United States and a strong argument in favor of protective tariffs. Certainly if England were permitted to import freely to this country her inferior and cheap iron and hardware, our manufacturers could not keep their hands busy, and the workmen, and all those depending on their prosperity, would suffer.

Earliest Water and Gas Supply of London.—London was first supplied with water through pipes in 1236, and by the successive giving out of the wells and the increasing population, the system was gradually extended. The most important addition of olden times was the basin near Islington, with an aqueduct called the New River, 48 miles long, begun in 1608 and finished in 1613. The aqueduct has since been enlarged and the length reduced to 28 miles by cutting off the loops. The principal pipes used at that time were trunks of elm trees, bored with augers, such as are now from time to time dug up in the streets of New York, as remnants of the earliest water-works here. The earliest lead pipes used in London were made of sheet lead soldered together. Since the time mentioned various other water-works were executed by different companies, until at present water is supplied from eight different sources. Gas was first introduced in 1807.

Practical Hints in Regard to Cements.

The mixing of hydraulic cement and sand, without lime, for the purpose of laying foundations, is thus described by one of the first authorities on the subject—General Gillmore:

"Each batch of mortar or concrete corresponds to one cask, or 308 pounds net, of hydraulic cement powder. 1st. The sand is spread in a rectangular layer 2 inches thick. 2d. The dry cement is spread equally all over the sand. 3d. The cement and sand are very thoroughly mixed by four men. 4th. A basin is formed by drawing the material to the outer edge of the bed. 5th. Water is poured into the basin thus made. 6th. The material is thrown back upon the water, absorbing it, when the bed occupies the same space that it did in the beginning. 7th. The bed is completely turned twice. If the mortar is for masons' use, it is heaped up, to be carried where required. If for concrete, the broken stone is spread equally over the bed, a bucket of water, more or less, according to the absorbing power of the stone and the temperature, is sprinkled over it, and finally the bed is turned and heaped up, the heaping being equivalent to a second turning."

It is stated by General Gillmore that recent experiments show that most American cements will sustain, without any great loss of strength, a dose of lime paste equal to that of the cement paste; while a dose equal to one-half or three fourths the volume of cement paste may safely be added to any energetic Rosendale cement, without damaging the mortar to any great extent. This addition of lime does not entirely unfit the mortars for submarine work, while a cheaper material is got, and by the use of lime it is prevented from setting too quickly. The mortar used at Forts Richmond and Tompkins, New York harbor, for stone masonry or concrete, was made by hand, and composed of hydraulic cement and sand, without lime, as here described.

In regard to common mortar, Gen. Gillmore gives the following rules: "1st. All the lime necessary for any required quantity of mortar should be slacked at least one day before it is incorporated with the sand. 2d. The sand basin to receive the unslacked lime should be coated over on the inside with lime paste, to prevent the escape of water. 3d. All the water required to slack the lime to a stiff paste should be poured on at once; this will completely submerge the quicklime. The heap should then be covered over with tarpaulin or old canvas, and left till next day. 4th. The ingredients should be thoroughly mixed, and the mortar heaped up for future use."

The Beton Coignet, used for numerous purposes in France for some time past, is composed of 4 to 5 parts of sand, 1 of lime (common or hydraulic), and from ¼ to ⅛ parts of cement, all in volume. This material is molded into blocks, and possesses the characteristics of the softer stones, weighing 3,700 pounds to the cubic yard, and having a crushing strength of from 2,600 to 7,500 pounds per square inch.

The ordinary concrete or beton, as used for foundations, is a mixture of hydraulic cement with some coarse material, as broken stone, brick, shells, or gravel. The product is an artificial conglomerate, which, when well made, has the strength of stone masonry, and is exceedingly convenient in many localities where large stones cannot be laid. It is very largely employed, not only for foundations, but also for the backing of walls in the filling of piers; and it has recently been used for stone throughout entire structures. It may be laid down in horizontal beds over wide areas, or it may be made into blocks and used as stone.

The proportion of cement should be such as to form good mortar with the sand alone; and the mortar thus made should be somewhat in excess of the spaces to be filled, that the coarse material may be quite surrounded. The amount of mortar required will be reduced by the mixing of coarse and fine materials, the latter helping to fill the spaces between the former.

At the request of a correspondent we add here some information in regard to the application of such concrete to important works abroad and in this country. The breakwaters at Dover, England, and at Alderney, in the English Channel, have been largely built of blocks of concrete. At Marseilles, France, concrete blocks weighing 22 tons each and of 353 cubic feet, were employed for the protection of the seaward slopes of the jetties. Blocks of the same size were used at the Mole of Algiers. The Cherbourg breakwater, the parapet of which is 30 feet wide at the base and 31 feet high, rests on a bed of concrete 7 feet thick, and is protected on the seaward side by concrete blocks, containing 720 cubic feet each, and weighing 44 tons. The concrete foundation at one of the Graving docks at Toulon is 400 feet long, 100 feet wide, and 15 feet thick, in a single mass.

The concrete for the foundation of the sea wall at Lovell's Island, in Boston harbor, was made as follows: Cement, 1 cask=3.75 cubic feet stiff paste; sand, 10½ cubic feet, damp and loose. Result, 11 cubic feet of mortar, or 10½ cubic feet, quite stiff, as used to make the concrete. With this was mixed 31½ cubic feet of shingle from the beach, composed of pebbles of all sizes, from those as small as peas to stones 6 inches in diameter. The concrete resulting made 33¾ cubic feet.

The foundation courses of a part of the scrap wall at Fort Warren rest upon a bed of concrete about a foot thick. The mortar was richer than that mentioned above, the proportions being: Cement, 900 pounds=10½ cubic feet stiff paste; sand, 21 cubic feet, damp and loose. The result was about 22 cubic feet of mortar. In laying the pintle blocks for the Barbette guns on the cover face, where the ground was dryer, a portion of fat lime was used for the concrete, as follows: Lime, 1 cask=8 cubic feet stiff paste; cement, 975 pounds=11.25 feet stiff paste; sand, 42 cubic feet, damp and loose. This produced 40 cubic feet of stiff mortar, with which was mixed 67½ cubic feet of granite fragments and 33¾ cubic feet of beach gravel, making in all 100 cubic feet of the small stones, and with the mortar 115½ cubic feet of concrete, weighing about 116 pounds per cubic foot.

The concrete at Fort Warren was prepared by first spreading out the gravel on a platform of rough boards, in a layer from 8 to 12 inches thick, the smaller pebbles at the bottom and the larger on top, and afterward spreading the mortar over it as uniformly as possible. The materials were then mixed by four men, two with shovels and two with hoes, the former facing each other, and always working from the outside of the heap to the center, then stepping back and recommencing in the same way, and thus continuing the operation until the whole mass was turned. The men with the hoes worked each in conjunction with a shoveller, and were required to rub well into the mortar each shovelful as it was turned and spread, or rather scattered on the platform by a jerking motion. The heap was turned a second time in the same manner, but in the opposite direction, and the ingredients were thus thoroughly mixed, the surface of every pebble being well covered with mortar. Two turnings were usually enough to make the mixture complete, the resulting mass being 33¾ cubic feet of concrete, which was carried to the trench in barrows and levelled, and well rammed in layers about a foot thick. The maul was a cylinder of wood 8×8 inches with a handle; the bottom was faced with a piece of thick sheet-iron. The concrete should be rammed until a film of water appears upon the surface, but not enough to make it quake.

The foundation concrete at Forts Richmond and Tompkins, New York harbor, was composed of: Cement, 1 cask, 308 pounds net=3.65 to 3.70 cubic feet stiff paste; sand, 3 casks, or 12 cubic feet, loose. The result was 11.75 cubic feet of rather thin mortar, to which was added 5 casks (20 cubic feet) of granite fragments, producing in all 21¾ cubic feet of concrete when rammed into the foundation. The concrete for the superstructure at the above works contained 11.75 feet of mortar and 16 of stone fragments. The foundation concrete contained about one-12th of its bulk of stones, from ¼ to ¾ of a cubic foot, rammed into the heart of the wall as the concrete was laid.

The concrete at the Quincy Bridge consisted of 2 cubic yards of Quincy limestone, screened and broken to pass through a 2½ inch ring, 3½ barrels of Falls City (Louisville) cement, and 3½ barrels of coarse river sand. When the broken stone was not screened, the proportion of sand was diminished, the intention being to have one part cement, one sand, and four broken stone, by bulk. At the Kansas City Bridge the beton consisted of 8 parts limestone, broken to pass through a 3-inch ring, 2 of sand, and 3 of cement.

It is an interesting fact that both the masonry and beton were laid in the above works during severe winter weather, by the use of hot sand and hot water. At the Quincy Bridge during the coldest days each stone was held over a brazier of charcoal to draw out the frost. The mortar thus used was found the following spring to be as hard and perfect as any on the work.

The World's Commerce.

Dr. Neuman, of Stuttgart, Germany, has completed a book on the subject of the world's commerce, upon which he has bestowed a great deal of labor, and which covers the subject very fully. He puts down the total wealth of Great Britain at $4,500,000,000, with an average yearly increase of over $125,000,000. The grain trade, or rather that part of it exported, which of course is but small compared with the whole, proves a tenth part of the international commerce of the world. The coal production he estimates at nearly 300,000,000 tons; it has doubled since 1860. Nearly 14,000,000 tons of iron are manufactured yearly, though the industry is comparatively in its infancy. The consumption of iron is yet less than one pound per annum for the majority of the inhabitants of the world. Such countries as Russia use up 10 pounds of iron per head per annum.

The imports and exports of each country may be stated in round numbers as follows:

	Millions.	Millions.
Great Britain	3,260	
Germany	1,600	
France	1,520	
Balance of Europe	3,600	
United States	1,090	
Brazil	210	
Canada	180	
Balance of America	620—	2,100
British India	470	
China	230	
Japan	70	
Balance of Asia	340—	1,140
Australia	460	
Africa	300	

The internal however is the great trade of the United States, which of course does not at all appear in the above figures.

Another Nickel-Plating Process.

Professor Slatba has devised and made public a process of nickel-plating in the wet way, without the use of the battery, which is said to give good results, and is not patented. The process is described as follows; "To a dilute solution of chlorid of zinc (5 to 10 per cent) enough nickel sulphate is to be added to impart a decidedly green color to it, and the solution is then to be heated to boiling in a porcelain vessel. The clouding of the liquid from the separation of a basic zinc salt need not be heeded, as it will not interfere with the effectiveness of the bath. The articles to be nickel-coated—first carefully cleaned of oxid or grease—are to suspended in the solution from 30 to 60 minutes, the bath being kept at a boiling temperature. When the articles are observed to be uniformly coated, they may be removed, washed in water in which a little chalk is suspended, dried, and finally polished with chalk, or other suitable material. By the substitution of a cobalt salt in place of the nickel, objects may be similarly coated with cobalt."

Endless Ropes for Rapid Transit.

Mr. Haussknecht, the inventor of the absurd rapid transit plan which we noticed in our last number (page 102), sends us a letter in which he expresses his utter disgust at what he calls our "absurd editorial." He says: "My circular presents two practical, separate plans, and describes their mode or manner of operation, which must not be mixed up like an Irish stew, showing that the editor does not understand them," etc.

To this we remark that our account is no more mixed up than the inventor's own circular, from which it appears that he wants to use compressed air to raise the cars to the top of the inclines of "25 feet fall to the mile, by which they will attain a speed of about 20 miles per hour by the law of gravity," . . . "utilizing the force of speed, it will run up a part of the hight it has come down, rear car striking against truck platform to stop. The conductor presses his foot on rope lever, opens lower valve, admitting compressed air into cylinder, driving piston connected with four-wheeled truck, car riding thereon, upwards on inclined rails, delivering car automatically to the next section; the conductor pulls the rope, shuts the valve, the used air escapes, permits the truck to descend, in readiness to receive succeeding car, when he is on his way to next station; time consumed, say one quarter of a minute."

The circular further states: "The endless rope system is automatically to connect with the inclined plane system, but is intended for steep grades, which no ordinary locomotive can ascend. . . . Also of much larger transporting capacity than the unfortunate New York rapid transit system. The structure is very similar to the inclined plane system, but having stationary wheels for the continuously travelling ropes to rest on. The power is supplied by gearings at the ends, and the compressed air travelling to the various sections, enters a rotary fan drum, setting the large driving wheels with ropes in operation. The conductor grapples the rope to start, or releases his grapple to stop. It must be understood that the cars going down hill balance those coming up."

Mr. Haussknecht says in his letter that he predicted the failure of the Greenwich street plan, because "no engine can pull the rope with four-wheeled carriers when journals are overheated, because the wheels of said carriers were too many and too small for speed." This may be true, but this is not the reason why the system of endless ropes was abandoned in Greenwich street. Even if the road had been constructed after a method which Mr. Haussknecht may consider perfection it would have been the same thing; it is a fact that wherever the rope system has been adopted and retained circumstances were peculiarly favorable for the same, and the grade could not otherwise be overcome except at great cost and loss of time.

Mr. Haussknecht further says in his letter: "Does the editor know that endless rope systems for railroads have been in successful operation for many years by Elberfeld in Prussia, in Germany, France, Switzerland, Belgium, Pennsylvania, California, and even a short walk from New York, in Hoboken up Bergen Point, and of some 30°, about 482 feet high, carrying up cars, passengers, and horses safely on a platform truck."

To this the editor answers that he not only knows all this, but has travelled on most of the roads named, and many others besides. He went up and down the Elberfeld incline in 1847; it is not an endless rope, but the trains are attached to the ends of the same wire rope, the down train balancing the up train, while in many cases the stationary engine has little or no work to do, the locomotive of the two trains being often sufficient to move them. He has travelled on the famous Belgium incline, descending the valley of the Meuse near Liege; nor is there an endless rope here, the trains being hoisted up by a rope winding on huge drums, while the descending trains move by gravity alone and have their momentum regulated by a separate car attached to the rear and provided with special brake arrangements. It is the same with some inclines of lesser importance in France and Switzerland; in regard to Pennsylvania, the inclines which used to be in operation thirty years ago near Philadelphia, where the trains were hoisted up by stationary engines, have all been abandoned. It was the same near Albany, where the trains for Schenectady were hoisted up an incline to the summit of the tableland west of Albany; this also has been done away with and a gradual incline constructed north of the city. The system has been retained for several inclines at and near Mauch Chunk on the Lehigh river; also for the ascent of the Moosic mountain near Carbondale, and near the Lackawanna river at Honesdale; and this for the simple reason that the trains on these roads are not drawn by locomotives at all, but move by gravity on a series of inclines. The topographical condition of the region being mountainous makes it easy to construct any kind of grades along the slopes of the mountains 1,000 and 2,000 feet high; but to recommend such a system in a city which is comparatively level, is absurd. The different inclined planes in Cincinnati ought to be mentioned in this connection; they are similar to that in Hoboken, but three times as high; nor is there an endless rope here, but the up truck balances the down truck, each being attached to the end of one wire rope, moved by a stationary engine on the top of the hill.

All these roads have been visited and studied by the editor, and he will only add that during a trip he made last summer over most all the railroads penetrating the interior of the Rocky Mountains in Colorado, he was struck with the ingenuity displayed by engineering the most difficult grades, ascending hights of 3,000 or 4,000 feet, without having recourse to ropes, endless or otherwise; not a single stationary train-hoisting engine was to be seen. Thus at Black Hawk the ascent is made by a series of switch-backs; and at the famous Veta Pass the road winds upward along the sides and around the mountains until Alamosa is reached, situated near the frontier of New Mexico, at the head-waters of the Colorado, about 10,000 feet high.

Experience has taught that the great problem of modern engineering is to avoid the very system recommended by Mr. Haussknecht, and for this reason we cannot comply with his request to publish his circular in full, so as to invite discussion. It has already been given more attention in our columns than perhaps the whole affair is worth, because it is a matter pretty well disposed of by all engineers who possess sufficient information on the subject, while we are perfectly satisfied that very few would have considered it worthy of as much notice as we have already given it.

Oatmeal as Food.

It is surprising how enormous the consumption of oatmeal has increased in our cities within the past few years; but we suspect that its merits as a cheap and highly nutritious food are not so generally appreciated in this country. Every one knows how generally it is eaten in Scotland, and in some parts of England it is equally popular as an article of diet. In West Cumberland, West Moreland, and North Lancashire, especially in the rural parts, it forms the staple of food, not only among the laboring classes, but also in the families of tradesmen and the well-to-do; the children of most of them have porridge at least once a day. For the past forty years, with very rare exceptions, (says a gentleman), I have made my breakfast off a pint of oatmeal porridge, and nothing else, fasting four hours after. If however, I take any other form of breakfast, I find myself very hungry before the next meal, which is never the case when I have had my porridge. I feel assured that if the laborers of the Southern countries, with their children, would take a basin of oatmeal and milk porridge night and morning, with such other food as they can procure in the interval, we should have a much stronger and healthier race of men and women than now exist.

TABLE OF THE PRINCIPAL PROPERTIES OF COMMON METALS.

Name of Metal.	Specific Gravity.	Chemical Equivalent.	Temperature. Melting point. Degrees.	Crushing Strength.	Tensile Strength.	Solvent.
Gold, cast	12.5	196	2,280	20,000	20,000	Aqua regia.
" wire	19.33	...	...	....	30,000	"
Silver, cast	10.3	108	1,830	50,000	41,000	Nitric acid,
" wire	10.5	...	...	....	60,000	"
Copper, cast	8.4	64	2,200	117,000	19,000	Boiling sulphuric acid.
" sheet	8.7	..	...	....	30,000	" "
" wire	8.95	..	...	....	60,000	" "
Nickel, cast	8.6	59	3,000	200,000	....	Hydrocyanic acid.
Brass, cast	7.3	..	1,500	165,000	18,000	Hot sulphuric acid.
" sheet	7.5	..	...	170,000	....	" "
" wire, hard	7.6	..	...	170,000	80,000	" "
" " annealed	...	..	...	100,000	50,000	" "
Tin, cast	7.2	118	446	16,000	5,000	Hydrochloric acid.
" wire	7.4	...	...	....	7,000	" "
Lead, cast	11.3	207	617	8,000	1,000	Acetic acid.
" wire	11.4	...	...	....	1,100	" "
Zinc, cast	6.5	65	700	....	3,000	Sulphuric acid. The oxids in caustic soda.
" sheet	7	..	...	....	16,000	
" wire	7	..	...	....	22,000	
Iron, cast	7.1	..	1,700	63,000	16,000	Sulphuric acid.
" " best	7.5	..	1,900	160,000	28,000	" "
" rolled	7.9	65	2,500	....	45,000	" "
" bar	...	..	...	38,000	60,000	" "
" wire	7.4	..	...	....	75,000	" "
Steel, cast	...	..	2,000	250,000	78,000	" "
" Bessemer	...	..	...	....	100,000	" "
" wire	...	..	...	....	225,000	" "
" chrome	...	..	...	....	180,000	" "
" tempered	...	..	...	....	214,000	" "
Bismuth	9.8	210	509	....	3,200	Nitric acid.
Antimony	6.7	122	840	....	1,000	" "

Table of Properties of Metals.

The second column contains the specific gravity, which is the weight compared with an equal bulk of water as unit, or, according to the metrical system, the weight of a cubic decimeter of the metal expressed in kilograms, or the weight of a cubic centimeter of the metal expressed in grams, the weight of a cubic centimeter of water being accepted as the unit of all weights, and called gram.

The third column is the chemical equivalent, representing the quantity, by weight, of the metal required to enter in chemical combination with other equivalent quantities, so as to form perfect compounds.

The fourth column contains the temperatures of the melting points of the metals, in degrees Fahrenheit.

The fifth column represents the weight in pounds which will crush a block of a cubic inch of the metal.

The sixth column represents the weight in pounds required to rupture a bar of one square inch section.

The seventh column represents the most common solvents used to act on the metals and change them into soluble salts, which in solution may be used for reducing them to the metallic state by an electric current—that is, for electroplating.

Explosion of an Agricultural Engine.

Last September a threshing engine exploded at Palmyra, New York. The results were interesting enough for the Hartford Steam Boiler Inspection and Insurance Company to have them photographed, and we here present to our readers engravings correctly copied from the photographs.

It was guaranteed by the manufacturer that the engine required no skillful engineer to run it, as it could not get out of order; this was the reason why the owner bought it, as he was satisfied that he himself was not a skillful engineer. The result was as follows:

A brisk fire was started on the second day that it was used; the owner, who acted as his own engineer, then went to breakfast. On his return, while steam

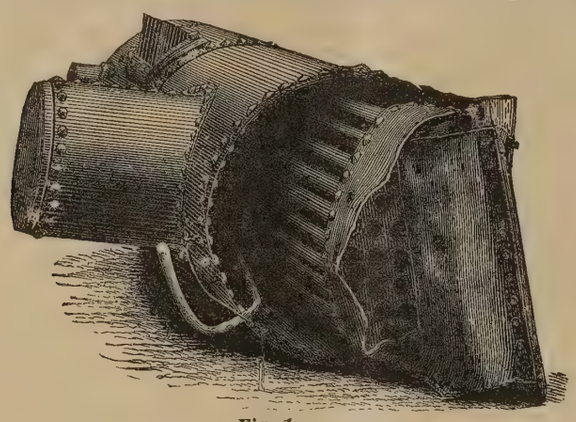


Fig. 1.

was or had been blowing off, he was oiling the engine, standing on top of it or on the truck wheel, when the boiler exploded, throwing his body high in the air, tearing it to pieces, and scattering the parts into an adjoining orchard, where they arrived over the tops of the trees. His clothing was entirely torn from the body and was found hanging in the top of a tree near where the engine stood. Three other men were injured, two of them very seriously.

The boiler, of which Fig. 1 represents the wreck, was of the locomotive type, the engraving showing the dome and tubes. It was built the same year that it exploded; the iron plates were ¼ inch thick, and it was intended to be worked at a pressure of 80 pounds; there were 39 tubes of 2 inches diameter and 5 feet long. It was mounted on a truck, and the explosion threw the principal part (Fig. 1) to the rear of the barn, where the separator stood, upon which it landed, passing in its flight near two men who stood in the doorway.

Two hundred yards from the principal boiler part (Fig. 1), and in an opposite direction from the boiler, was found the fire-box, in a corn-field; it was photographed on the spot where found, and is represented in Fig. 2.

The wreck of the truck upon which engine stood is represented in Fig. 3; it was not found thus, but the pieces were scattered in all directions and collected together to make the photograph of all of them at once.

So much for steam engines which are said to require no skillful engineer; so much for ¼-inch iron for steam boilers; so much for insufficient provision with stays in the fire-box, where there was the greatest strain and the greatest exposure to the flame. The figures show that the iron plates of the fire-box were shot out of the boiler to a distance of 200 yards, while the recoil made the boiler fly in an opposite direction.

We hope designers of boilers and boiler makers will ponder over this, as it is an instructive lesson.

INDUSTRIAL EXHIBITION AT ANTWERP.—The United States Consul at Antwerp informs the department of State, that an Industrial Exhibition will be opened at Antwerp, in August, 1879, which will be worthy of universal attention. Space has been allotted for American products. The consul commends the exhibition to the artisans and producers of the United States. Correspondence may be opened with and consignments sent to S. H. Haine, 39 Rue Houblonnière, Antwerp, Belgium, who will take charge of American goods. He has already received a number of consignments to his care from the United States. Goods should be in Antwerp before the 1st of August next.

Improvements in the System of Extinguishing Fires.

The plan suggested to protect New York city against conflagrations, by building reservoirs sufficiently elevated to give as high a pressure as is furnished by the steam engines, will probably be put in practice in London. The great advantages are evident. The firemen

Fig. 2.

will then not need to transport the engines, and will be even entirely freed from the care of them, while the city will be relieved of the expense of purchasing and repairing these costly pieces of apparatus, subject to much wear and tear. The management of the fire department will then be to make the firemen form patrols in connection with the police, and if a fire breaks out all that is necessary is to attach the hose, turn on the water at the nearest high-pressure hydrants, and streams of water can then be poured upon the flames without waiting for the engine; the fire may then have already been largely diminished, or perhaps entirely extinguished, before a larger force of firemen arrives. The value of a few minutes saved at the commencement of a conflagration, as everybody knows, can scarcely

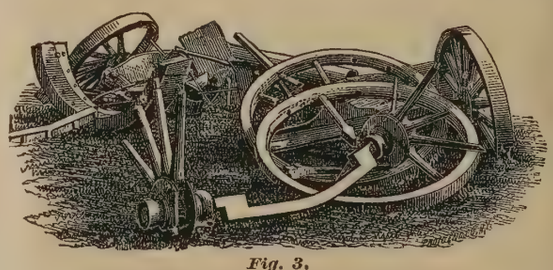


Fig. 3.

be overrated. If water can at once be thrown on the incipient flames, the chances of putting out the fire are vastly increased; while even a very brief delay may allow the flames to get such headway that they cannot be successfully resisted.

It is believed by the Parliamentary committee that the system of hydrants, supplied by high pressure, will afford a greater degree of protection against fire than has ever been enjoyed, and that its establishment will diminish the expenses of fire departments very materially. The trouble about introducing it into London, however, is that the water supply of the largest capital of the world is far from sufficient. The captain of the Fire Brigade reports that last year in no less than fifty-one cases serious embarrassment was occasioned in London by the lack of efficient arrangements for the furnishing of water to put out fires. In nine cases there was a short supply of water, in thirty-three a tardy attendance of turn-cocks, and in nine no attendance at all. The imperative need of remedying so great an evil is apparent to every one acquainted with the subject, and until it is remedied the proposed hydrants cannot be successfully introduced.

This same trouble has been predicted for New York, notwithstanding our water supply is much more abundant than that of London; but our inventive genius is equal to the occasion; it has been suggested here to fill these reservoirs with sea water, pumped up from the river, at some locality where it is not contaminated with city sewage, the only objection being that the damage, always more or less done by water while extinguishing a fire, may be somewhat greater if this water is salt than if it is fresh; but this is a minor consideration when the protection of a city against a large conflagration is in question.

Efforts are now being made in London to defeat the scheme of establishing such a continuous water supply at high pressure, for it involves a large outlay, and London is not a homogeneous city which can be readily awakened to an interest in a project which has in view the benefit of all the parishes, and not that of a single one. What is known as the city—that is, the ancient center of London, confines its care to those within its boundaries, and the paralyzing effect of parish administration is felt on all sides. It will be necessary to conquer narrow feelings before any such comprehensive measure as the proposed elevated reservoir and its system of hydrants can be carried out. In this respect New York city has a great advantage, as the American people do not foster unwise conservatism. We hope however that the improvement in London will eventually be secured and the whole city enjoy its advantages.

In regard to the comparative strength of the New York and London fire departments, it may be interesting to our readers to be informed that the number of men employed by our Fire Department is 854; of these 736 are firemen proper, belonging to the uniformed force. The large district of London under the control of the Metropolitan Board, containing nearly four times the population of New York, is protected by only 406 firemen, including the chief officer, the superintendents, and all ranks—a surprisingly small number of men for so great a work. Employed on the several watches kept up throughout the metropolis at 50 fire engine stations, 4 floating stations, at 108 fire escape stations, are 174 men during the night and 94 during the day, making a total of 268. This leaves a remainder of 138 men available for general work at fires. Should a great conflagration occur at one end of London, every fireman would be required to be on hand there; if therefore a large fire should start up in another quarter of the city during the progress of the first, the consequences would be very serious.

It will thus be seen that we have about twice the force of London, though our population is only about a quarter as large. The London Fire Brigade, however, watches over a city far less liable to fires than New York, and the efficiency of our Fire Department has been often proved to the satisfaction and pride of every well meaning citizen.

Relation of Steam Pressure and Temperature.

In order to determine the pressure of watery vapor at various temperatures, two different kinds of apparatus are used, one for temperatures below 212° Fah. and one for temperatures above 212° Fah., when the vapor is called steam.

Fig. 1.

Fig. 2.

The apparatus, Fig. 1, is used for the purpose first mentioned; it consists of a double barometer, or two barometric tubes, plunged into the same reservoir below. One of the two tubes (that at the right side) is an ordinary barometer; in the other at the left side a little water covers the mercury, which water evaporates partially in the vacuum and fills it. To both tubes and the reservoir a rod *f* is attached, by which they can be immersed in a high glass vessel filled with water, heated to various temperatures between the freezing and boiling points—32° and 212° Fah. This temperature is observed by plunging a thermometer into the same vessel; and in order to find the elasticity of the vapor corresponding with any given temperature, all that is necessary is to compare the hight of the mercurial column in the two barometers, which, of course, being submitted to the same temperature as the thermometer, can show no other difference but that due to the expansion of the watery vapor.

It is now some 70 years since Dalton determined in this way the elasticity of watery vapors at low temperatures. In order to measure the tension of the vapor—that means, to determine how much watery vapor under pressure can raise the mercurial column—the apparatus Fig. 2 is used. It is an ordinary cistern barometer, in which, in the cistern, water is placed over the mercury; this water is boiled, and while its steam escapes the opening is hermetically sealed by melting the glass with a blow-pipe; this is done in order to drive out all the air, which would interfere with the results. While cooling the vapor condenses, and the atmospheric pressure being excluded, the mercury in the long end of the tube will descend, and the instrument will be changed from an ordinary barometer measuring the pressure of the atmosphere, into a barometer measuring the pressure of watery vapor.

Thus it has been found that even at the freezing point of water the tension of the vapor able to raise the mercury was measurable. Even below that temperature the ice formed over the mercury had the power to raise the latter; and it was shown that even ice evaporates with a power sufficient to overcome slight resistances. In order to make experiments at low temperatures, the apparatus Fig. 2 is immersed in a mixture of ice and salt, and it is found that the mercury in the two sides of the tube will never come to exactly the same level, proving what is stated above. Even at zero Fah. the rise is measurable, and found to be about one-16th of an inch; at 32°, one-5th of an inch; at 80°, 1 inch; at 100°, 2 inches; at 130°, 4 inches; at 150, 8 inches; at 180°, 16 inches; and at 212°, 30 inches, balancing at that point the atmospheric pressure. When the temperature is raised above that the tension of the vapor becomes greater than the atmospheric pressure, and the water boils, the escaping vapor or steam carrying off the surplus heat, and thus keeps the temperature in an open vessel down to 212° Fah. When the vessel is closed, however, the results are different, as the vapor, when it cannot escape, exerts a pressure which is measured by an apparatus similar to that represented in Fig. 2, only with the difference that the tube is open at the top, and is longer, so as to add atmospheric pressure to the column, and to be able to measure higher pressures than 2 atmospheres; the mercury will stand at the same hight in both tube and cistern. The cistern is entirely filled with water and sealed, which will only commence to form vapor when the temperature is higher than the boiling point of water, (212° Fah.), then it will begin to cause a rise of the mercury in the tube. In order to obtain these higher temperatures the barometer is placed in oil, which can be heated to much higher temperatures than water. The hight of the mercurial column will give the tension of the vapor above the atmospheric pressure in inches of mercury, every two of which correspond very nearly to one pound of pressure to the square inch. This apparatus, when the tube is long enough, can be used to measure pressures of 3 and 4 atmospheres, every atmosphere corresponding to about 30 inches. Instead of so long a tube a shorter one can be used, closed at the top, and then called a manometer; it is filled with dry air over the mercury. When the watery vapor drives the mercury upward, this compresses the air, and from the amount of this compression the tension of the watery vapors can be easily determined, remembering that for a pressure double that of one atmosphere, the enclosed air is compressed to half its volume; for a triple pressure, to one-third; for a quadruple pressure, one-fourth, and so on, according to a general law, which is that the volumes are inversely proportional to the pressures, and which, after its discoverer, is called the law of Mariotte. This law, however, has been found to be not absolutely correct, that is, for very high pressures, and to deviate more or less for different kinds of gases. When experimenting with pressures surpassing several atmospheres great difficulties were encountered. No reliable data were known until the French Academy of Sciences charged Arago and Dulong with the task of determining the elasticity of watery vapor, or steam, to such high temperatures and pressures as could be of any industrial application. As a preliminary labor, they verified, by means of a manometer acted upon by hydraulic pressure, the correctness of Mariotte's law, to a pressure of 400 pounds to the square inch, or 27 atmospheres.

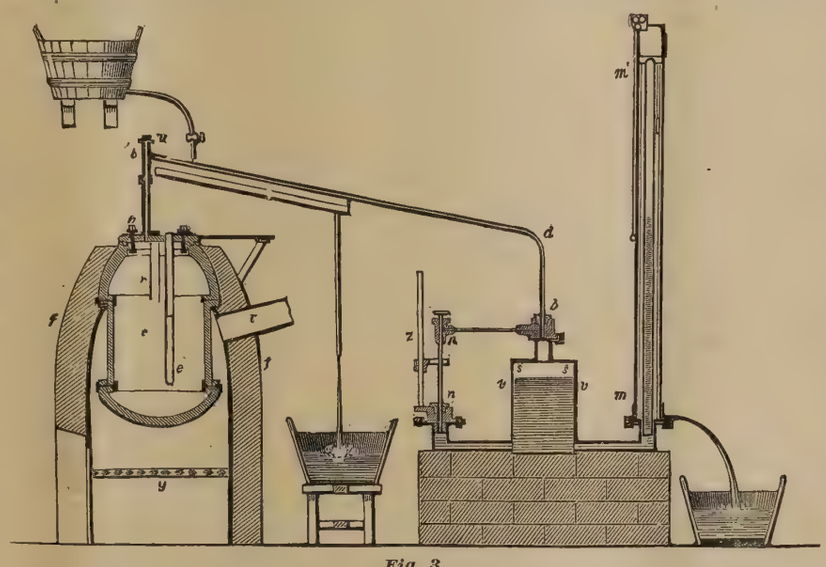


Fig. 3.

The apparatus used by them is represented in Fig. 3, and consists of a strong sheet-iron steam boiler *c*, containing about 20 gallons of water; the cylindrical part, which was the weakest, was made of iron more than half an inch thick. Our figure shows the furnace wall *f f*, the grate in *y*, and the flue in *r*. If the thermometer used for the determination of the temperature had been placed in the boiler itself it might have been compressed by the tension of the steam, and shown a higher temperature, as was really the case. In order to prevent this, two musket barrels *e* and *r* had been fixed to the cover; they were open at the top but closed below, and filled with mercury. One of these barrels reached deep under the water, and the other into the steam space above without touching the water; a thermometer was placed in each, so that with one the temperature of the water and with the other the temperature of the steam could be observed. The upper ends of the tubes of these thermometers were bent in a horizontal direction; but as this part, when exposed to cold, possesses a lower temperature, which might vary, this variation was done away with by passing over this part of the tube a stream of water of a constant temperature. Fig. 4 shows this arrangement in detail, *r* being the thermometer in the the gun barrel in the boiler, while the scale is in the upper horizontal glass tube, through which a steady stream of water flows, so as to keep the temperature uniform, regulated by a separate small thermometer inside the same.

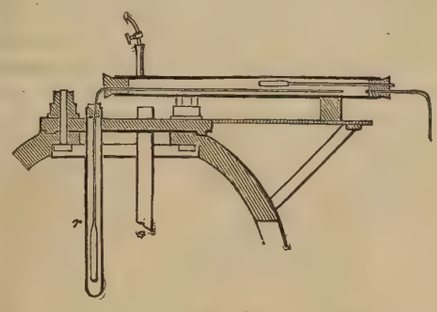


Fig. 4.

In order to measure the tension of the steam, the same thermometer was used which had served to verify the law of Mariotte to 27 atmospheres pressure; but instead of using hydraulic pressure, the steam from the boiler was used to exert itself. In the vertical pipe *b*, Fig. 3, on top of the boiler, the steam entered and pressed upon the top of a column of water in the inclined pipe *u*, and was transferred from there at *d b* to the vessel *v v*, partially filled with mercury, which was connected with the mercurial column in the manometer *m m*; as the pressure required to raise the mercury in the manometer to different points of its scale had been carefully determined beforehand, the pressure exerted by the steam could thus also be easily determined. Two directions were applied, one for the difference in vertical hight between the water in *u* and the surface of the mercury in *v v*, the other for the variable hight of the mercury in the latter vessel. To prevent the water in *u* from becoming heated by the steam, a constant stream of water of uniform temperature was passed over it from the elevated tub, seen at the upper left-hand corner.

The experiments were made by first placing in the furnace a certain amount of fuel, regulated so as to obtain a greater or less amount of heat as desired, then igniting it, and opening the safety valves until the water boiled, so as to drive out all air; then the valves were closed, when the temperature and manometer rose until stationary for the heat attained; as soon as a stationary point was reached the temperature and corresponding pressure were written down.

An attempt has been made to construct a general formula which will give the pressure of steam at any given temperature. That of Tredgold is this:

$$\text{Log } e = \frac{23{,}94571\ t}{800+3\ l} - 2{,}296{,}038$$

In which e is the tension desired and t the temperature, according to the centigrade scale. It has been found that this formula is only correct to 4 atmospheres, and that above four atmospheres the following more simple formula corresponds better with the results obtained in practice:

$$e=(1+0.7153\ t)\ 5$$

By means of the latter formula, which is correct to 50 atmospheres, the tension of steam has been calculated to 930° Fah., which is red-hot superheated steam, and found to exert a pressure of 1,000 atmospheres. It must be understood that this tension is only obtained when the steam is in contact with water, and the water heated at the same time to that temperature. Dry steam heated separately from water attains far less pressure, as it expands only like air and other gases, only doubling its pressure at an addition of some 600° Fah. of heat.

Scientific.

GALLIUM, THE NEW METALLIC ELEMENT.—Within the last twenty years five new metallic elements have been discovered, while some evidence of a sixth new metallic element has recently been put on record. It is gallium, which was first recognized by M. Lecoq de Boisbaudran in the autumn of 1875, and so named by him in honor of the land of its discovery—France. Like its predecessors, rubidium, caesium, indium, and thallium, the new metal gallium was discovered by the process of spectrum analysis, applied in this instance in a special manner contrived by the ingenuity of M. de Boisbaudran, long eminent as a spectroscopist. The spectrum of gallium is characterized by two marked violet lines, the less refrangible of them being especially brilliant. Hitherto the new metal has been recognized only in certain varieties of zinc blende, that of Pierrefitte in the Pyrenees having furnished the chief portion of gallium thus far obtained from any source whatever, nearly half a ton of this ore having been employed by M. De Boisbaudran to furnish the dozen grains or so of metal wherewith he has been able to establish the leading properties of the element. In its appearance gallium manifests a general resemblance to lead, but it is not so blue-tinted or quite so soft, though it is readily malleable, flexible, and capable of being cut with a knife. Like lead again, and unlike zinc, gallium is not an easily volatile metal; unlike lead, however, it acquires only a very slight tarnish on exposure to moist air, and undergoes scarcely any calcination at a red heat. The specific gravity of gallium is a little under 6, that of aluminum being 2.6, that of zinc 7.1, and that of lead 11.4. A most remarkable property of gallium is its low melting point; it liquefies completely at 86° Fah, or below the heat of the hand, and, still more curiously, when once melted at this temperature, it may be cooled down even to the freezing point of water without solidifying, and be kept unchanged in the liquid state for months. Indeed, in the original communication of its discovery to the French Academy, it was described as a new liquid metal, similar to mercury; but on touching with a fragment of solid gallium a portion of the liquid metal in this state of so-called sur-fusion, it at once solidifies. Unlike lead again, gallium is a highly crystalline metal, its form being that of a square octahedron. In its chemical habitudes the rare element gallium shows the greatest analogy to the abundant element aluminum. In particular it forms a sort of alum not to be distinguished in its appearance from ordinary alum, but containing oxid of gallium instead of oxid of aluminum or alumina.

But the chief interest of gallium, from a scientific point of view, is connected with the history of its discovery. All previously known elements have been discovered, so to speak, accidentally, and their properties have not in any way been foreseen, but rather met with as subjects of surprise; but the blende of Pierrefitte was deliberately taken up for examination by M. De Boisbaudran in the expectation of finding a new element—an expectation to which he was led, in the course of his study of the spectra of known elements, by a train of speculation of which he has not yet made known the details. The existence of an element having the characteristic properties of gallium was, moreover upon entirely different grounds, predicted very definitely by a Russian chemist, M. Mendelejeff, in 1871, and in a more general way several years earlier by an English chemist, Mr. Newlands. This double prediction was based on a study of the relations of the known atomic numbers of the elements. These numbers have only lately been perceived to form a tolerably continuous seriation, which again is associated in a remarkable manner with the seriation in properties of the elements themselves. In the series of numbers, however, certain terms are here and there missing, and in particular a number was missing which should belong to an element having properties intermediate between those of aluminum and iridium. What these properties would be was predicted in most minute detail by M. Mendelejeff in 1871; he predicted, for example, that the specific gravity of the missing metal would prove to be about 5.9. Operating on very small quantities, M. De Boisbaudran, in the first instance, found the specific gravity of gallium to be 4.7; but on repeating his determination in 1876, with special precautions and on a somewhat larger though still very small scale, he found it to be exactly 5.935—certainly a most remarkable fulfillment of the prediction with regard to it.

WILD SPECULATION IN MAGNETO-ELECTRICITY.—Some parties who ought to know better, as they are engaged in electric telegraphy, are so ignorant in regard to the fundamental principles of mechanics and of magnetism as to believe that the Gary motor will be a success. In this supposition there is, in their opinion, no limit to the power which, in this way, can be produced out of nothing; and they speculate on the adaptation of this power for driving magneto-electric machines for the production of electric light, which in this case would cost nothing except the interest on the money invested, and the wear and tear of the machinery employed.

The New York *Times* reports that Mr. Moses G. Crane, a prominent practical electrician, who has a large workshop at Newton, near Boston, for the manufacture of electrical apparatus, expressed himself as follows: "There is no doubt of Mr. Gary's having discovered a most important principle in magnetism." He had not examined the workings of the Gary magnetic motor, and would express no opinion as to the extent to which it could be developed, but he felt that there were good reasons for Mr. Gary's claim; the principle itself was the main thing after all. As to its application to the generation of electricity for the production of light, he felt that there was every reason to expect a great result—perfect success. The experimental tests that had been brought to his notice, made with small magnets, indicated that Mr. Gary would accomplish everything that he expected to attain in this direction, and he felt the more confidence from the fact that Mr. Gary was first advised to develop his discovery concerning the utility of magnetism for the purpose of electric light, by a gentleman for whose judgment he, as well as all other, both practical and theoretical, electricians had the highest regard.

It is stated that the widespread interest felt in the invention is shown by the letters received by Mr. Gary from all parts of the country, including Memphis, Chicago, San Francisco, Washington, and many other large cities, asking his terms for the use of his machines by electric light companies organizing in these places. He has also received many letters from large manufacturing establishments, stating that they wished to order his machines as soon as they could be turned out. In the meantime, it is reported, that Mr. Gary has not neglected his motor, but has made important improvements in it; by a change in the position of the magnets in the rotary engine he has succeeded in doubling its power, so that he now expects it to be fully as practical for general use as the steam engine.

Complaints are made by Mr. Gary's friends that his motor and its principle are receiving savage attacks and severe denunciation from those who have not seen it, and who dismiss the whole thing with the autocratic declaration that "if new discoveries are to be made in magnetism, one can safely affirm that it will not be by the employment of tenpenny nails and pocket magnets." To these Mr. Gary says he is "too busy to reply, confident that the practical results will be the best answer."

This is perfectly true, therefore we wish Mr. Gary to come forward with his machine, and not take pattern after Keely, and keep improving all the time without ever showing any practical results. All that is known about Mr. Gary's motor are statements like the following:

"With one of the small working models, constructed of a few 10-inch magnets, he has lifted a weight of 7 pounds 1 foot from the floor within a minute's time, and he himself is satisfied that he can obtain by his principle the same amount of power from permanent magnets that has already been obtained from electro-magnets, and which would long since have been made use of had it not been for the great expense of the batteries. Mr. Gary has been invited to exhibit and explain his machines before the Society of Arts connected with the Massachusetts Institute of Technology in Boston, and will comply as soon as he has finished the work now in hand."

This statement was made last January. What about the results of the exhibition promised? He also promised to appear before the Polytechnic Club of New York, but has not yet done so.

SCIENTIFIC CULTURE IN THE UNITED STATES.—The criticism of an American scientific investigator by a European scientist would, some ten years ago, have ruined the prospects of the American of ever being recognized as having done anything useful. But, very fortunately for our present American scientists, this is no longer so, and it has become a conceded fact, not in England and France only, but in German centers of science, as exclusive as the universities, that there are certain foci of scientific culture in the United States which are not to be despised. "Germany today," observed a distinguished pioneer of American science recently, "has commenced to fear the physical experimentalists of the United States more than she fears those of any other country, and has long since practically adopted a kind of protective tariff in the department of scientific discovery." But the strain to which the best scientific minds are subject by this never-sleeping spirit of emulation, (competition it would be styled in any other department of industry), is such that they either break down in a few years or are driven into sensationalism to maintain their reputation. It is an open secret that when Huxley came to this country, it was by medical advice, to save the last remnant of an exhausted brain and an impaired intellect. The Huxley of ten or twelve years ago must not be confounded with the decrepit man who, in his speech, so greatly disappointed the members of the American Scientific Association assembled in Buffalo, in 1877, and afterward delivered that feeble series of lectures before New York audiences, provoking among those who did not know the facts, the question: "How did this man acquire his tremendous reputation?"

Perhaps the most amusing feature of that brief campaign, at least to those who were in the secret, was the eagerness with which our theologians put on their polemical armor and rode lance in rest against this enfeebled giant of science, who had nothing left but the gigantic skeleton of his former self to sustain the shock, and was here by the advice of his physician, to be nursed and humored rather than assailed. To elude the obscurity which emulation was sure to bring, Tyndall went into sensationalism, and propounded those theories of straw before the British Association

which the theological world has been so long engaged in knocking down. "The cause of this," said the venerable Prof. John W. Draper, on one occasion, "is very simple. Science has become one of the principal attractions of the modern university, and has thus a high commercial value in drawing students. The result is that the professors in the various departments of physics must either be constantly making important additions to the aggregate of scientific discovery, or lose their prestige as educational leaders. It is no longer a question of a few lectures and standard experiments during the session; the demand for new experiments is urgent, and must be met, and no man who has not experienced the tax upon his brain and nervous system of this constant but silent pressure, can possibly understand why the incumbents of the scientific professorships in our colleges break down sometimes so prematurely."

Compressed Air for Driving Locomotives.—An atmospheric locomotive engine, designed by Major Beaumont, of the Royal Engineers, has been on trial at the Woolwich arsenal for some time past, and appears likely to be attended with success. The apparatus consists of a large number of elongated cylinders—about 70 in all—piled together in an oblique stack, each cylinder being some 4 inches in diameter and about 6 feet long. Mounted on an ordinary truck, and by the ordinary crank arrangement, the compressed air stored in the cylinders has been found to exercise power sufficient to draw a light load for a considerable distance, and to keep up speed for a long time before requiring to be replenished.

Curious Difference Between the Expansion of Wrought-Iron and Cast-Steel.—If a piece of cast-steel be made red-hot and quenched in cold water it will become longer, but if the same operation be performed upon a piece of wrought-iron it will become shorter. The precise amount of the alteration, or its variation in different qualities of each metal, has never been determined, although it is of great importance in workshop manipulation.

A Contribution to the History of Submarine Telegraphy.

1839.—Dr. O'Shaugnessy, of Calcutta, sunk a copper wire, wrapped with cotton thread saturated with tar, across the Hoogley river, a distance of one mile, and transmitted signals through the same.

1842.—Morse laid a submarine wire across New York harbor, but the isolation was so very defective that it would not work, and was not used.

1843.—Prof. Morse, after detailing the results of some of his experiments, writes to the Secretary of the Treasury as follows: "The practical inference is that a telegraphic communication on the electro-magnetic plan may with certainty be established across the Atlantic Ocean. Startling as this may now seem, I am confident that the time will come when this project will be realized."

1847.—Mr. A. J. Craver, of Newark, N. J., placed an isolated wire over the bottom of a little brook which crossed the line of telegraph between New York and Washington. He connected this at both ends with the wire through the air, so as to run the messages sent from New York to Washington, and *vice versa*, across this submerged wire, and he found that there was not the least interruption in the course of the messages.

1848.—The first practical submarine cable was laid across the Hudson River, from New York to the New Jersey shore. This was undertaken in consequence of the success of Mr. Craver with his wire across the little brook mentioned above; and its signal success led to the final abandonment of the air line across the river, which was stretched between the tops of two high masts, one standing on the Palisades near Fort Lee, and the other on the opposite New York shore, where the river is the narrowest. It is there, however, 3 miles wide, and the wire 200 feet high in the air at its lowest part, was frequently damaged by storms, being always stretched to very nearly its limit of cohesion, and the breakage interrupting the line so often, not to speak of the continual expense of repairs, its abandonment was quite natural, especially as the submarine cable, which contained several wires, was rarely interrupted, except by anchors of vessels; but this was soon remedied by notifying all ship-masters and having large signs erected on both shores where the cable was landed, with this notice:

"Cable Crossing—Don't Anchor,"

which may now be seen at several places along navigable rivers where bridges do not afford the means for crossing by an air line or protection to a submarine cable. At most drawbridges the telegraph wires now run over or under the bridge, and only at the draws they are connected with a short piece of submarine cable, the ends of which are raised out of the water on each side of the draws, and contain several well isolated wires, to give an opportunity to accommodate several land lines.

1851.—Mr. F. N. Gisborne attempted to make a partial air and partial submarine line from St. Johns, at the eastern end of the island of Newfoundland, to New York. He intended to make St. Johns the terminus of a line of swift steamers to Europe, which could reach it from Ireland in five or six days, when the news would at once have been transmitted to New York. He commenced work before funds to carry it on were secured, and had to abandon it, resulting in bankrupting him. The principal cause was that New York capitalists became unwilling to invest in an enterprise that would benefit St. Johns more than New York.

1854.—Mr. Gisborne met in New York Mr. Matthew D. Field, a brother of Cyrus W. Field, explained his plans, and Mr. M. D. Field promised to speak to his brother about it. He did so, but Cyrus W. Field, at first reluctant to have anything to do with telegraphy of any kind, at last consented to see Mr. Gisborne at his house. After the interview, the following idea occurred to Mr. Field: "Why confine ourselves to establishing telegraphic communication with the most eastern point of land of this continent? Why not go further, and span the Atlantic Ocean with a submarine wire." Mr. Field was, in respect to this idea, in the same mental condition that Professor Morse was when he first conceived the electric telegraph—both did not know that others had suggested the same idea, and had already taken practical steps for its accomplishment. But both had energy and persistency to carry the thing through—Morse his electric telegraph, which Prof. Henry had long before suggested and practically tried; and Field the Atlantic cable, which Lieutenant Maury had already studied out, while Lieutenant Berryman had made the deep sea soundings from Ireland to Newfoundland (the cable plateau as it is now called), and did this a year before Mr. Field thought of it.

Mr. Cyrus Field wrote at once to Lieutenant Maury, of the National Observatory at Washington, in regard to the hydrographical difficulties, and to Prof. Morse in regard to the electrical question. The answers from Lieutenant Maury and Prof. Morse were of course favorable; he next consulted Mr. Peter Cooper, chiefly in regard to furnishing the capital for so great an enterprise. Mr. Cooper was willing to take part in it and furnish $100,000, provided others would do the same, so as to have half a million dollars to start with. The balance was furnished by Messrs. Moses Taylor, Marshal O. Roberts, and Chandler White. These five formed a company, of which the first step was to buy the charter of Gisborne's Newfoundland company, and to obtain further concessions from the Colonial government. They were obtained, and at the end of 1854 Mr. Field went to London to contract for a cable across Northumberland Straits, 50 miles wide; this cable was lost in August, 1855, in the attempt to lay it, by paying it out from the bark in which it had been loaded. This accident proved the necessity of using steamers for laying submarine cables.

1856.—A new cable was successfully laid, and the different series of land lines being ready, direct communication between New York and St. Johns was established. Thus far $1,000,000 had been expended, of which Mr. Field contributed more $200,000, while the negotiations, overseeing, correspondence, etc., also fell on him.

In the same year Mr. Field went to England, and was successful in interesting English engineers, electricians and capitalists, who made up the balance of the money required—one and three-quarter millions—of which Mr. Field furnished more than one-fourth. A cable 2,000 nautical miles in length was manufactured, and after several unfortunate mishaps, consisting in breakage, was at last successfully landed, August 5th, 1858. Within the next twenty-four hours 400 messages were sent, when suddenly communication ceased, the cable having been damaged by the use of too strong a battery applied to it in England. After some delay, the natural result of the grievous disappointment, a new cable, much heavier and stronger than the first, and 2,300 miles long, was commenced. Its weight was such that no ordinary vessel could carry it; fortunately the steamer "Great Eastern," the largest vessel ever built, had almost bankrupted her owners, and was for sale; some friends of the cable company bought her for a small fraction of what she had cost, and offered to charter her to the company, on the condition of no success no pay. At last, in June, 1865, the new cable was ready and on board; the laying began, and after paying out 1,200 miles, the cable parted again, and the 1,200 miles paid out were lost. The work was delayed for another year, and the only thing left was to reorganize the company and solicit subscriptions for new stock; but such was the confidence, notwithstanding the disasters, that more than a million dollars was subscribed before the stock was offered to the public. In four months' time 1,700 miles of cable were ready, with improved machinery; on July 13, 1866, the "Great Eastern left Ireland, paid out the cable, and on the 27th of July reached Newfoundland with the cable end, without meeting a single accident. She then went back to grapple for the end of the 1,200 miles lost the year before; after three weeks' fishing, it was successfully hauled on board, and being attached to the telegraphic apparatus, a signal was sent to Ireland and answered, proving that the end was in good order. It was then spliced, and the "Great Eastern" went again to Newfoundland and safely landed that also, so that two cables were completed.

Keeping Alive without Eating.

From time to time cases are reported of persons of sickly constitutions, for whom it is claimed that they use no food at all—that they never eat anything. Close investigation, however, has shown that in every case the word *never* is rather too strong, and that we come nearer the truth when we say *hardly ever*.

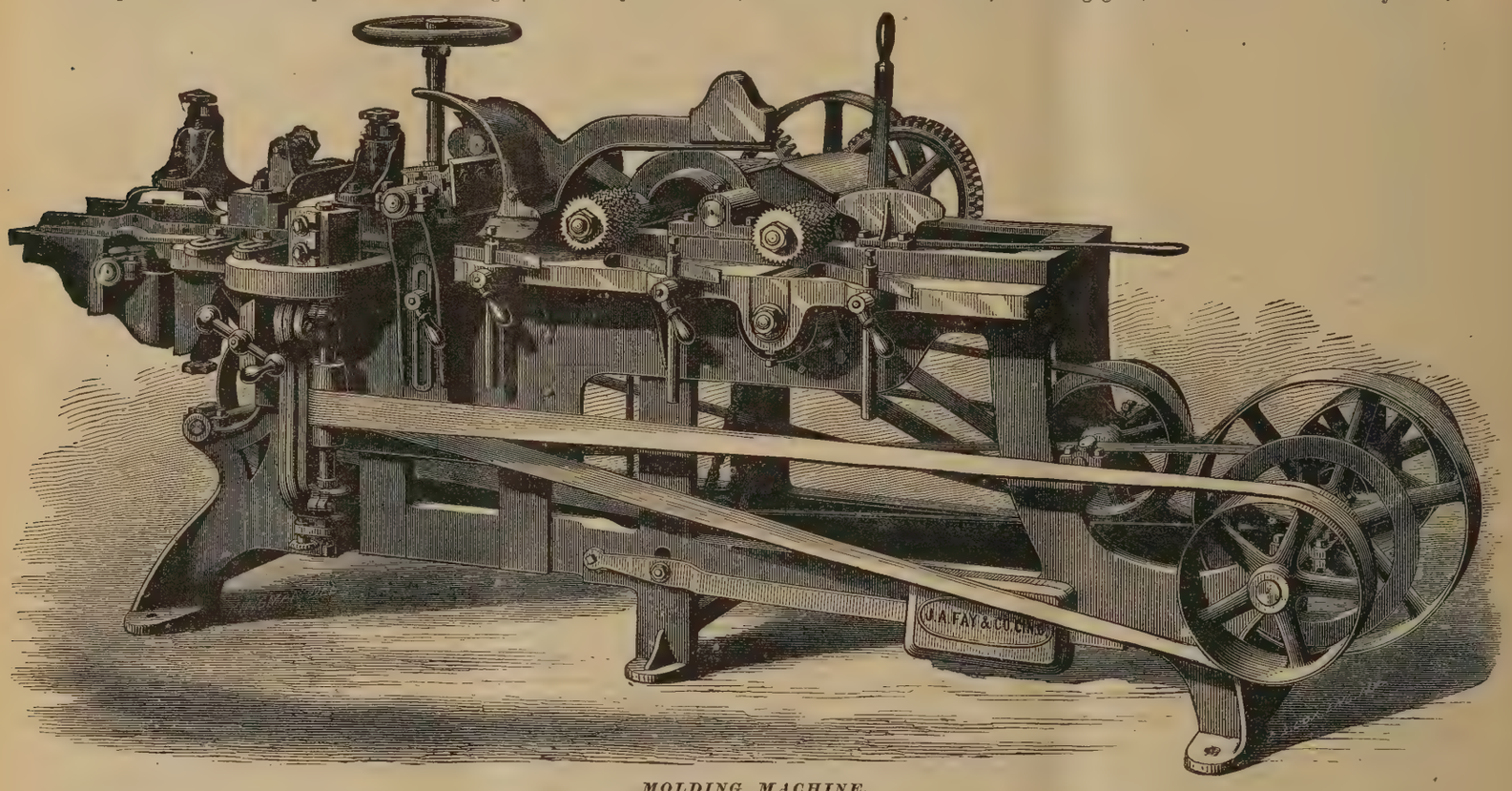
One of the cases which we personally remember was that of Miss Engeltje Van der Vliet, who for years was visited by the curious on a farm where she lived, near Delft, Holland, and whom we saw in 1847. It was claimed that she never ate anything; at last she died, and the *post mortem* examination discovered in her stomach strawberries and cream, while the condition of the digestive organs showed that she had regularly enjoyed the delicacies of the seasons, which were procured for her by a faithful servant, who obtained them for herself and generously shared everything with her mistress, of course secretly, as the exhibition of her absteminous lady was quite profitable to both.

The case of Miss Mollie Fancher, of Brooklyn, N. Y., is similar, but of a higher order, as this lady is both a clairvoyant and medium, for whom it is pretended that the Moxa or burning process does not even redden the skin, and that while at home in her room she can see any of her friends who may be crossing Fulton ferry. This is what her friends testify to. We think that in their admiration for this lady, and their intense love for the wonderful, they go rather too far, and tell so many surprising, and even absurd stories, that in the end nothing will be believed.

Large Molding Machines.

The want of large molding machines has steadily become more and more urgent, and it was found that the principle on which small machines worked could be successfully applied (of course with necessary modifications) to large machines intended for heavy work, designed to make molding up to 8 and 10 inches wide, and working three and four sides. Such work of course requires a very large, heavy and powerful machine, constructed in the most thorough manner. The machine illustrated on this page combines these essentials; it is the production of J. A. Fay & Co., and for sale at the Geo. Place Machinery Agency, 121 Chambers and 103 Reade streets, New York.

This machine combines all the important improvements which a long experience in building this class of machinery has suggested, so that the result obtained is the production of the most perfect work at the highest attainable speed. This is realized by several precautions, such as having all the shafts and turned fittings finished to standard sizes, screws turned, heads and threads made to a regular system, holes bored and tapped to exactly correspond, and all parts balanced with the utmost care; journal bearing reamed and scraped, the very best materials used, and every part fully inspected and tested before leaving the works. The journals run in long, patented, self-lubricating bearings, lined with the best lining material, and so constructed as to flood the arbor constantly with oil. The machine is fitted with top, bottom and side cutters, which work simultaneously on four sides, enabling them to work single or double moldings, or to plane, rabbet, groove or tongue and bead at one operation, with a capacity of from 15 to 30 feet per minute. The main spindle is of large diameter, with provision to take up any end-play by wear, and the gateway is gibbed to the frame, so it can be laterally adjusted without unloosening bolts. Both side spindles have vertical and lateral adjustments, while the outside spindle is arranged to work at varying angles. The under cylinder has a vertical movement independent of the bed, enabling the operator to vary the cut without altering the cutters, and the cutter heads are made of steel, slotted on all four sides, so that any form of cutter can be used. It has a weighted shaving bonnet and pressure shoe, which can be swung clear of the bed, giving ready access to the cutters. The feed works are of the strongest possible kind; the rolls are of large diameter and heavily weighted, and driven by improved gearing of more than triple their diameter. The feed rolls rise parallel to the stuff being worked, and are so weighted as to secure uniform pressure at all times. The lower roll in the platen is also a driven roll, and the bed will drop to take in 13 inches, and every part, including cutter head, arbors, etc., is easily accessible. The machine is supplied with patent tight and loose pulleys, which not only relieve the strain of the belt, but diminish the friction on the pulleys. It has two changes of feed, full set of pressure bars, springs, wrenches, etc., and is claimed to be unequalled in its ability to produce good work. Matcher heads and cutters furnished, when wanted, for flooring; also extra heads and profile cutters for every style of molding. The tight and loose pulleys are 10 inches in diameter by 6 inches face, and should make 1,000 revolutions per minute in order to perform the maximum amount of first-class work.



MOLDING MACHINE.

Asphalt and Timber Floors.

A new method of laying down floors has been adopted in France, and is said to have obtained a wide application. It consists in putting down a floor, not as hitherto, on joists, but in embedding the boarding in asphalt. The new floors are used mostly for ground stories of barracks and hospitals, as well as for churches and courts of law. Pieces of oak, usually 2½ to 4 inches broad, 12 to 30 inches long, and 1 inch thick, are pressed down into a layer of hot asphalt not quite half an inch thick, in the well-known herring-bone pattern. To insure a complete adhesion of the wood to the asphalt, and obtain the smallest possible joints, the edges of the pieces of wood are planed down, bevelling toward the bottom, so that their cross section becomes wedge-like. Nails of course are not necessary, and a perfectly level surface may be given to the flooring by planing after the laying down is completed.

The advantages of this flooring, which only requires an even bed upon which to rest, are said to be the following: 1st. Damp from below and its consequence—rot, are prevented. 2d. Floors may be cleaned quickly and with the least amount of water, insuring rapid drying. 3d. Vermin cannot accumulate in the joints. 4th. Unhealthy exhalations from the soil cannot penetrate into living rooms; asphalt being impermeable to damp, rooms become perfectly healthy, even if they are not vaulted underneath. In buildings consisting of several stories, as in hospitals, the vitiated air of the lower rooms cannot ascend, an object which it has hitherto been impossible to attain by any other means. 5th. The layer of asphalt will also prevent the spreading of fire from one floor to another in case of conflagration.

Recipes for Making Water-Glass.

1. *Soluble Potash-Glass.*—The recipe of Fuch is to take 15 parts of pulverized quartz or pure quartz sand, 10 of purified potash, and 1 of charcoal powder; mix them, put in a fire-proof crucible, and expose in a blast furnace for about 6 hours to a heat equal to that used for melting glass, until the mass is uniformly fused; then pulverize and expose to the air, pour cold water over from time to time, so as to wash out all potash not combined with the silica. The glass formed and left behind is only fusible in hot water. To do this, break it up, pulverize, and boil it in 5 parts of water for about four hours, stir continually, and add water to supply that lost by evaporation; keep boiling until a film forms on the surface, which indicates that sufficient concentration has been reached. The specific gravity should be about 1.25 Beaume, but for some purposes it may contain more water.

2. *Neutral Soluble Potash-Glass.*—Water-glass as above prepared is very sharp and alkaline. In order to make it neutral, or at least less alkaline, it must be boiled with freshly precipitated silica, or with silicious infusorial earth, as long as any silica will dissolve in it.

ROQUEFORT CHEESE OIL.—All flavors are being isolated, and found to consist of volatile oils. The last is the pungent, and to some people disagreeable flavor of Roquefort cheese. Mr. Mencki has distilled this cheese with sulphuric acid, which destroyed the casein, etc., and drove the flavor out as a vapor, which, by condensation, was found to consist of a yellowish clear oil, of neutral reaction, and of a sharp burning taste. When largely diluted it gave the very flavor of Roquefort cheese, so relished by gourmands.

Latest Market Report of Building Materials.

NEW YORK PRICES.

ARTICLES MARKED WITH A STAR (*) ARE QUOTED IN GOLD.

—o—

LUMBER.

Pine, very choice and extra dry, per M	$55 00 @ 60 00
Pine, good	45 00 @ 50 00
Pine, shipping box	18 00 @ 22 00
Pine, common box	16 00 @ 17 00
Pine, common box, ⅝	13 00 @ 15 00
Pine, tally plank, 1¼, 10 inch, dressed, each	40 @ 43
Pine, tally plank, 1¼, 2d quality	35 @ 38
Pine, tally plank, 1¼, culls	25 @ 28
Pine, tally boards, dressed, good	28 @ 30
Pine, tally boards, dressed, common	22 @ 25
Pine, tally boards, culls, dressed	21 @ 23
Pine, strip boards, merchantable	16 @ 18
Pine, strip boards, clear	22 @ 25
Pine, strip plank, dressed, clear	33 @ 35
Spruce boards, dressed	18 @ 20
Spruce plank, 1¼-inch, dressed	22 @ 25
Spruce plank, 2 inch,	28 @ 34
Spruce wall strips	13 @ — 15
Spruce timber, per M	16 00 @ 19 00
Hemlock boards, each	14 @ — 16
Hemlock joist, 2½x4	15 @ — 16
Hemlock joist, 3x4	16 @ — 18
Hemlock joist, 4x6	40 @ — 44
Ash, good, per M	30 00 @ 50 00
Oak	32 50 @ 65 00
Maple culls	20 00 @ 25 00
Maple good	45 00 @ 85 50
Chestnut	42 00 @ 48 00
Cypress, 1, 1½, 2, and 2½-inch	35 00 @ 40 00
Black walnut, good to choice	85 00 @100 00
Black walnut, ⅝-inch	75 00 @ 85 00
Black walnut, selected and seasoned	110 00 @150 00
Black walnut counters, per ft	12½ @ 20
Cherry, wide, per M	85 00 @100 00
Cherry, ordinary	60 00 @ 80 00
White wood, chair plank	60 00 @ 70 00
White wood, inch	25 00 @ 45 00
White wood, ⅝-inch	30 00 @ 45 00
White wood, ⅝ panels	35 00 @ 50 00
Shingles, extra shaved pine, 18-inch	9 50 @ 10 00
Shingles, extra shaved pine, 16-inch	8 50 @ 9 50
Shingles, extra sawed pine, 18-inch	7 00 @ 8 00
Shingles, clear sawed pine, 18-inch	6 50 @ 7 50
Shingles, cypress, 24x7	20 00 @ 22 00
Shingles, cypress, 20x6	12 00 @ 15 00
Lath, Cargo rate	— — @ 1 40
Yellow dressed pine flooring	25 00 @ 35 00
Yellow pine girders	30 00 @ 40 00
Locust posts, 8 feet, per inch	18 @ 20
Locust posts, 10 feet	24 @ 25
Locust posts, 12 feet	29 @ 34
Chestnut posts, per ft	3 @ 3½
Basswood per M	25 00 @ 30 00

BRICKS.

Nominally.	Cargo.	Afloat.
Pale, per M.	2 00 @	3 50
Up River	4 50 @	5 00
Haverstraw Bay	5 25 @	5 37½
" " choice	5 50 @	— —
Favorite Brands	6 00 @	— —
Hollow Fire-Clay Brick	9 00 @	9 25

FRONTS.

Croton—Brown, per M.	7 00 @ 8 00
" Dark	8 00 @ 9 00
" Red	9 00 @ 9 50
Philadelphia	26 00 @ 28 00
Trenton	24 00 @ 29 00
Baltimore	34 00 @ 38 00

Yard prices 50 cents per M higher, or with delivery added $2 per M for hard and $3 per M for front brick. For delivery add $5 on Philadelphia and Trenton, and $6 on Baltimore brick.

IRON—PER TON.

Duty.—Bar, 1 to 1½c. per lb.; Railroad, 70c. per 100 lbs.; Boiler and Plate, 1½c. per lb.; Sheet, Band, Hoop and Scroll, 1¾ to 1¾c. per lb.; Pig, $7 per ton; Polished Sheet, 3c. per lb.; Galvanized, 2½c. per lb.; Scrap Cast, $6 per ton; Scrap Wrought, $8 per ton—all less 10 per cent. No Bar Iron to pay a less duty than 35 per cent ad val.

Pig, Scotch—Coltness	21 50 @ 22 50
" Glengarnock	20 50 @ 21 50
" Eglinton	19 50 @ 20 50
" American, No. 1	17 50 @ 19 00
" American, No. 2	16 50 @ 17 50
" American, forge	15 50 @ 16 00

	Store prices.	Cash.
Bar, Swedes, ordinary sizes	— 5 @	— 6
Bar, Swedes, nail-rod	— — @	— 6½

LEAD—PER 100 POUNDS.

*German	— — @ — —
*English, common	— — @ — —
*Spanish	— — @ — —
*Foreign, refined	— — @ — —
*Bar	5 00 @ — —
*Sheet and Pipe	5 00 @ 6 00
*Domestic	3 37 @ — —

NAILS—PER KEG.

10d to 60d, common, fence and sheathing	2 30 @ — —
8d and 9d, common	2 85 @ — —
6d and 7d, common	3 10 @ — —
4d and 5d, common	3 35 @ — —
3d and 4d, light	4 10 @ — —
3d, fine	4 85 @ — —
2d, fine	4 85 @ — —
Cut spikes, all sizes	2 85 @ — —
Clinch nails, 1½ to 1¾ inch	5 00 @ 5 25
do. 2 to 2¼ inch	4 75 @ — —
do. 2¼ to 2¾ inch	4 50 @ — —
do. 3 inch and longer	4 25 @ — —

TIN PLATES.—Duty, 1 1-10 cents per pound.

*I. C. charcoal, 10x14, per box	6 75 @ 7 00
*I. C. coke, 10x14	5 50 @ 6 25
*I. X. charcoal, 10x14	8 75 @ 9 00
*I. C. charcoal, 14x20	6 75 @ 7 00
*I. X. charcoal, 14x20	8 75 @ 9 00
*I. C. coke, 14x20	5 50 @ 6 25
*I. C. coke, terne, 14x20	5 25 @ 5 50
*I. C. charcoal, terne, 14x20	5 75 @ 6 25

ZINC.—Duty, sheet, per lb., 2½ cents.

Sheet, (cask) per lb	— — @ — 6½
Sheet, (open)	— — @ — 7

SOLDERS.

No. 1	— 9½ @ — 10½
No. 2	— 9 @ — 9¼

STONE.—Cargo Rates.

Amherst Freestone, in rough, per cubic foot	— — @ — 85
Berlin Freestone, in rough	— — @ — 95
Berea Freestone, in rough	— — @ — 75
Brown-Stone, Portland, Conn	1 25 @ 1 50
Brown Stone, Belleville, N. J	1 00 @ 1 50
Granite, rough	— 60 @ 1 25
Canaan Marble	1 25 @ 1 50
Dorchester, N.B., Stone, rough, per foot	— — @ 1 03

PAINTS.

*Carmine, American, per lb. gold	5 00 @ 5 50
Chalk, per lb.	— 00¼ @ — 00⅜
China Clay, per ton gold	20 00 @ 22 00
Chrome yellow, dry, per pound	— 12½ @ — 28
Lead, red American, per pound	— 7 @ — 8
Lead, white American, pure, in oil	— 7½ @ — 8
Lead, white American, pure, dry	— 6¾ @ — 7¼
Lead, white English, pure, in oil gold	— 10 @ — 10½
Litharge	— 7 @ — 8
*Ochre, Fr., dry, per 100 lbs	1 50 @ — —
Ochre, ground, in oil, per lb	— 6 @ — 15
Ochre, Vermont, per 100 lbs	— 75 @ 1 00
*Orange Mineral, English gold	— 9½ @ — 10
Paris White, American	— 1¾ @ — 1¼
Paris White, English, prime	— 1¾ @ — 2
Paris Green	— 15 @ — 28
Plumbago paint, patent, per lb	— — @ — 25
Putty, per lb	— 1¾ @ — 2½
Spanish Brown, dry, per lb	— 1⅜ @ — 1¾
Spanish Brown, ground in oil, per lb	— 8 @ — 9
Venetian red, per cwt	1 75 @ 2 00
*Vermilion, Chinese, per lb	— 80 @ — 90
*Vermilion, Trieste	— 70 @ — 80
*Vermilion, quicksilver, bags gold	— 55 @ — 57½
Vermilion, American, common	— 15 @ — 18
Whiting, per 100 lbs	— 40 @ — 75
Zinc, white American, dry, No. 1	— 6½ @ — 7½
Zinc, white American, No. 1, in oil	— 8 @ — 10
*Zinc, white French, dry, (Red Seal,) gold	— 8 @ — 8¼
Zinc, white French, in oil gold	— 10 @ — 10½

VARNISHES—PER GALLON.

American Wearing Body	3 50 @ 4 00
Coach Body	2 35 @ 3 50
do do	1 80 @ 2 00
Furniture	1 25 @ 2 50
Black Asphaltum	1 00 @ 1 50
Brown Japan	1 00 @ 1 20
Liquid Paint Dryer	1 35 @ 1 75
Harness, (black)	3 00 @ 4 50
Shellac, Spirits	3 00 @ 3 50

CEMENT—PER BARREL.

Portland (imported)	2 75 @ 3 50
Portland (American)	2 50 @ 2 90
Roman	2 70 @ 3 25
Keene's, coarse	6 50 @ 7 00
" fine	10 50 @ — —
Martin's, coarse	6 00 @ — —
" fine	10 50 @ — —
Rosendale	— 90 @ — —

DEADENING AND ROOFING MATERIAL.

Mineral Wool for Roofs and Deadening, per lb. — 1¼ @ — 1½

HAIR.

Cattle, per bushel of 7 lbs	— 9 @ — 12½
Goat, " "	— 15 @ — —

SLATE.

Purple roofing slate, per square	$6 00 @ 7 00
Green slate	6 00 @ 7 00
Red slate	10 00 @ 11 00
Black slate, Pennsylvania	5 00 @ 5 25
" " Cargo rate	3 25 @ 3 75
Slate tiles, 1¼-inch, rubbed, per square foot	20 @ — 25

PLASTER PARIS.

Duty.—20 per cent ad. val. on calcined; lump free.

Nova Scotia, white, per ton	2 80 @ 3 00
Nova Scotia, blue	2 75 @ 2 80
Calcined, Eastern and city, per bbl	1 00 @ 1 10
Calcined, city casting	1 15 @ 1 20
Calcined, city superfine	1 20 @ 1 25

LIME—PER BARREL.

State, common	— 55 @ — —
" finishing	— 85 @ — —
Rockland, common, cargo rate	— 70 @ — —
" finishing	— 85 @ — —
Ground	— 70 @ — —

Add 25 cents to above figures for yard rates.

FOREIGN WOODS.

MAHOGANY.

St. Domingo, crotches, ordinary to good, per ft	— 15 @ — 20
St. Domingo, crotches, fine	— 20 @ — 30
St. Domingo, logs, small	— 5 @ — 8
St. Domingo, logs, large	— 20 @ — 30
Frontera, Mexican, large	— 11½ @ — 16
Frontera, Mexican, small	— 8 @ — 10
Other Mexican	— 8 @ — 14
Honduras	— 10 @ — 15

ROSEWOOD.

Rio Janeiro, ordinary to good, per lb	— 2½ @ — 8
Rio Janeiro, good to fine	— 5 @ — 8
Bahia, ordinary to good	— 2 @ — 6½
Bahia, good to fine	— 4½ @ — 8
Honduras, per ton	10 00 @ 20 00
Satin Wood, per foot	— 15 @ — 60
Tulipwood, per lb	— 6 @ — 12½
Lignumvitæ, small, per ton	10 00 @ 20 00
Lignumvitæ, large	25 00 @ 50 00

CEDAR.

Cuba, per superficial foot	— 12½ @ — 16½
Mexican, small	— 8 @ — 10
Mexican, large	— 10 @ — 16
Florida	— 50 @ 2 00

DOORS, WINDOWS, AND BLINDS.

DOORS, RAISED PANELS, TWO SIDES.

2.0 x 6.0	1¼ inch.	$ 67	——
2.6 x 6.6	1¼	— 95	——
2.6 x 6.8	1¼	— 99	——
2.8 x 6.8	1¼	1 04	——

DOORS, MOLDED.

Size.	1¼ inches.	1½ inches.	1¾ inches.
2.0 x 6.0	$1 23	——	——
2.6 x 6.6	1 52	1 93	——
2.6 x 6.8	1 57	1 85	——
2.6 x 6.10	1 59	2 01	——
2.6 x 7.0	1 62	2 09	——
2.8 x 6.8	1 62	2 09	2 57
2.8 x 7.0	1 69	3 17	2 69
2.10 x 6.10	1 79	2 26	2 84
3.0 x 7.0	1 87	2 45	3 00

GENERAL REVIEW OF THE MARKETS.—While demand has not the past month increased to the extent that we felt justified in our last report in predicting, still there has been a very fair trade doing in most of the markets, with prospects of an increase during the present month. Competition has been exceedingly sharp and the buyer has of course had, as a consequence, the advantage. Supplies have not been excessive and have kept pretty evenly balanced with demand. The building interests are at present very active in this city, and the records of the Department of Buildings show an increase each week of projected buildings. This is certainly a very healthy sign, and one that leads to the belief that the markets will witness this summer a considerable improvement over the corresponding period of any year since the panic of 1873.

THE MARKETS IN DETAIL.—In the lumber market there has been little change during the month. Demand has been slow while prices have been in favor of the buyer. Occasionally, however, a falling off in the amount of stock available has admitted of a temporary show of steadiness, and has, in some cases, formed a basis for securing a slight advance.

In the brick market a comparatively steady tone has continued on the general market for common hards, and business has moved along without unusual feature. If anything the market is firmer than at the date of our last. Fronts have had a good average demand and have been steady, but sellers have complained of the low rates to which builders and contractors have endeavored to screw them down.

In the lime market trade has been agitated considerably by the action of one of the principal receivers in suddenly jamming the market down to 60 cents per barrel for Rockland common, and sold freely on spot and to arrive rather to the astonishment of the balance of the trade. After offers ceased at the above rates there was a reaction, and as we write the supposed market rate is 70 cents, but in reality there is no regular figure, and the situation is simply nominal.

In the lath market trade has shown pretty much the same general features as last month, and the only positive change is in the valuation. At the rates asked buyers have been unwilling to handle stock beyond the necessities of the hour, but those who have been compelled to operate have been obliged to submit, as the small amount offering has given the seller the entire advantge.

In the cement market the selling interest has been well pleased with the condition of the market, and the average report made has been of a cheerful character. Dealers and manufacturers' agents advise a sale of Rosendale fully equal to the supply available and indeed in excess as some of the mills are already contracted considerably ahead of production. On the foreign grades of Portland there has been a degree of animation, and the demand has in many cases exceeded the supply.

In the hardware market the general outward movement of stock has continued quite full, and the condition of business has been cheerful. Manufacturers and dealers have not been altogether satisfied with the margin they have secured, but hope to make the quantity of goods sold act as an offset and work the aggregate profit up accordingly. On prices there have been no important changes, and the general tone of the market has been quite uniform. Of supplies and assortments there have been enough for all wants.

In the metal markets American pig has found a steady sale, but sellers have been unable to secure any positive buoyancy. Scotch pig has been selling moderately at about former rates. Manufactured iron has been selling with quite seasonable freedom, but there has been a lack of enthusiasm to infuse vitality into values. Domestic lead in pig has been more active since our last, and prices have to some extent improved. Tin in pig has sold rather slowly, and in a somewhat uncertain manner, with values more or less nominal, though on the whole lacking strength. Tin plates have been slow of sale and generally weak on values with most of the current quotations on a nominal basis only. Sheet zinc has been dull.

The Piercing of the American Isthmus.

The eminent success of the Suez canal, cutting the great isthmus of the Old World and shortening the water-way from Europe to the East Indies many thousands of miles, is naturally drawing attention to the cutting of the great isthmus of the New World—that of Panama. If this were as easy to accomplish as the Eastern isthmus it would have been begun long ago, and ere this have been finished; but, unfortunately, nature has put in the way of this enterprise almost insurmountable obstacles in the shape of stupendous mountain chains, which would require the most enormous expense to tunnel; and besides this, a labor so gigantic that the life of a whole generation of men would be insufficient. These facts have been ascertained by various surveys, of which the principal ones were made in 1872 over the Isthmus of Tehuantepec; in 1873 over the Isthmus of Darien, and also in the Atrato Valley and Napipi River; in 1874 over Lake Nicaragua; in 1875 over the Isthmus of Panama, with location of canal from Panama to Aspinwall. These expeditions were all sent by the United States; besides these, French and English explorations have been made in other neighboring localities for the same purpose. The French engineer, De Lesseps, the originator of the Suez canal, has now identified himself with the undertaking, and in consequence of this an international Congress is now assembled in Paris to decide which route will be the most desirable.

M. De Lesseps is in favor of a ship canal, without locks, piercing the mountain chains on the level of the ocean, regardless of expense and the time required to finish it, so that sailing vessels and steamers can pass straight through without delay. There is one locality however which does not present the formidable obstacles of all the others, and which can be utilized without tunnelling; a series of locks can overcome the ascent and descent, while natural circumstances have provided lakes with plenty of water to feed the canal. This locality is Lake Nicaragua, and the majority of engineers appear to be in favor of this route, as it presents no serious obstacles whatever, while, as a secondary inducement to use that route, a country abounding in mineral and tropical wealth will be opened to commerce by passing one of the world's highways through its center.

Nicaragua is a solitary exception to the mountainous character of the whole of Central America. Four of the provinces—namely, Rivas, Granada, Leon, and Chinandega, the principal ones as regards the development of their agriculture, commerce and manufactures are level, especially the first named, which comprises the isthmus proper, and appears to be the most suitable locality for the canal. The materials which would be required for the construction of the work are found in inexhaustible quantities in the provinces referred to. Lime and stone quarries abound along the line of the canal.

Nicaragua possesses among its various lakes two which are especially worthy of attention—namely, Lake Managua and Lake Nicaragua. The former, which is smaller than the latter, and has 22 feet more altitude, flows into it through the Tipitapa River, and both together, with that natural canal, occupy an extent of nearly 200 miles in length. The shortest distance between the great lake and the Pacific Ocean is not greater than 10 miles, and, notwithstanding the curves of the line now proposed, which terminates at the port of Brito, the length does not exceed 16 miles. The large body of water which the great Nicaragua lake pours into the Atlantic through the San Juan river, its small elevation above the average level of the two oceans, (106 feet), the great relative depth of its waters, and other inestimable conditions, make that lake the true harbor of the canal, where all the squadrons of the world would at all times be able to find shelter. The insignificant elevation of the lake above the level of the oceans reduces extremely the number of locks which otherwise impede general traffic.

The entire length of the proposed Nicaragua canal, from ocean to ocean, is 181 miles, with a width of 150 feet and a depth of 26 feet. It is proposed to make Lake Nicaragua the summit level of the canal, and to connect the lake with the Pacific by canal, and with the Caribbean Sea by a combination of canal and slack water navigation. The proposed canal from the lake to the Pacific will have a total length of 16.33 miles; there will be 10 descending locks, each having a lift of 10.31 feet, besides a tide lock at the terminus of the canal, to admit ships at any stage of the tide. From the head of this section eastward to Fort San Carlos, at the head of the San Juan River, the distance is 56 miles; 26 feet of water can be carried, aided by some under-water blasting to deepen the channel, to the end of the canal. On the east side a channel would have to be deepened by dredging for a distance of about 7 miles, to a mean depth of some 8 feet, the bottom being a firm mud, without rock. As the water is always perfectly smooth east of the lake, a dredge could work every day of the year.

The Eastern division extends from Fort San Carlos, at the lake, to the harbor of San Juan del Norte, or Greytown; it is 108.43 miles in length, of which 63.02 miles are in slack water navigation, and 45.41 miles of inland canal. The San Juan river is proposed to be made navigable by four dams, to be located severally at Castillo, Balas, Machuca Rapids, and a mile below the confluence of the River San Carlos, with short canals along these dams, with a lock of 10.28 feet lift in each. Just below the mouth of the San Carlos the canal would be taken from the river and located along the valley of the river to the head of the Juanillo branch of the San Juan, thence by an almost straight line toward Greytown, at a distance of 41.90 miles from the point of leaving the San Juan at the mouth of the San Carlos. Out of this latter distance 36 miles would be in excavations and embankments combined, and 6 miles across low hills. Ten locks, 400 feet long and 70 wide, with walls 41 feet high, are proposed in this division, the first three located in the short canals around the dams and the remaining seven in the lower part.

An artificial harbor is proposed to be made at Brito by means of a breakwater and dredging. Suez as well as Port Said are artificial harbors. The dredging would extend over an area of 67 acres, which is thought to be sufficient to meet the traffic of the canal, particularly if the proximity of the lake is taken into consideration, where any number of vessels can find ample and safe anchorage. At the Atlantic side the harbor of San Juan del Norte, or Greytown, would be made available and improved, the sand bar removed, and the discharge of sand, brought down by the San Juan river, diverged by turning the lower water of the San Juan into its Colorado branch.

Careful and minute estimates for the accomplishment of this canal and accessories have been made by Civil Engineer A. G. Menocal, of the United States Navy. They are as follows in round numbers:

For the Western division, from the mouth of the Rio del Medio to the Pacific Ocean.	$22,000,000
For the Middle division, comprising lake navigation, from the mouth of the Del Medio to Fort San Carlos.	1,000,000
For the Eastern division, from San Carlos to Greytown; slack water navigation, 63.02 miles; inland canal, 45.41 miles; or 108.43 miles.	25,000,000
For the harbor of Brito.	2,000,000
For the harbor of Greytown.	3,000,000
Total	$53,000,000
Add 25 per cent for contingencies.	13,000,000
Giving a grand total of.	$66,000,000

The construction of this work, requiring neither tunnelling nor the formation of a deposit of water, the length of the purely artificial canal being so limited, and considering the small number of locks, the cost of improving ports, and of accessory labor of less importance required, the estimate of $66,000,000 can be considered a close approximation to the truth. This outlay, which is by no means exorbitant for an enterprise of such transcendent importance, could be diminished to the amount of several millions by a more detailed location of the proposed line, by the value of the lands which Nicaragua is disposed to grant in favor of the canal, and by the sums with which she would now aid the immediate improvement of navigation in the San Juan river. Even supposing the amount required to be double the above estimate, the commerce of the world would insure a remunerative interest. The Suez canal, costing not less than $100,000,000, the success of which was so long a matter of dispute, and whose importance will undoubtedly always be inferior to that of the American canal, is now an enterprise whose future prosperity is more than assured.

It is evident that the United States, and especially the cities on the Atlantic and Pacific seaboards, are most intensely interested in this great enterprise, as its accomplishment would at once double the importance of the great commercial center of this part of the world—New York city. Its business would increase as did that of Liverpool after the completion of the Suez canal. To prove this, we have only to remember that the water-way to San Francisco would be reduced from 19,000 to 5,000 miles, and to all the harbors along the Pacific Ocean in proportion. The distance to China would be reduced from 20,000 to 10,000; to the East Indies, from 17,000 to 9,000; and to Melbourne, Australia, from 13,000 to 9,000 miles. These figures will carry to every reflective mind the conviction of the importance and necessity of this enterprise.

What Postage Costs.

The St. Louis *Journal of Commerce* publishes some interesting statistics showing the amounts paid by manufacturing concerns in that city annually for postage. In the amounts opposite the names in the list below are included postal cards, postage on circulars and catalogues and regular letter postage. The firms mentioned are among the largest of their kind in the West. The difference in the amounts as given by these firms is chiefly due to the various plans by which their business is conducted. Some advertise their business by means of an extensive circulation of pamphlets, price-lists, and circulars; others depend on the columns of legitimate newspapers; and still others make use of neither of the above, preferring travelling men; and large manufacturing firms using the wire.

L. M. Rumsey & Co.	$6,000 00
Curtis & Co.	1,816 00
Semple, Birge & Co.	4,532 00
Goulds & Ostrander.	3,019 00
Sligo Steel Co.	1,000 32
D. M. Osborne & Co.	3,120 60
J. A. Field, Son & Co.	1,016 00
Paddock, Hawley & Co.	1,100 00
Whitman Agricultural Co.	3,011 72
J. E. Hayner & Co.	1,772 58
L. P. Ewald.	1,125 38
Excelsior Manufacturing Co.	3,000 82
Kingsland Ferguson & Co.	2,000 00
Deere, Mansur & Co.	1,500 00
A. F. Shapleigh & Co.	2,916 00
Samuel Cupples & Co.	4,212 00

IMPROVEMENT IN ANÆSTHETICS.—Prof. Bert, of Paris, uses a mixture of nitrous oxid or "laughing gas" and oxygen, in the proportion of 17 parts of the former to 3 parts of the latter, and applies it under pressure. The patient, with the physician armed with the gas bag containing the mixture, enter a large compressing chamber, in which the usual atmospheric pressure of 15 pounds per square inch is increased to about 20 pounds. It is claimed, and appears to be verified by the experience so far obtained from the performance of surgical operations, that it produces a more complete insensibility, and without the depressing or disagreeable after-effects, as is often the case with nitrous oxid or other anæsthetics, as commonly administered.

Home Department.

Clay Heaters vs. Iron Heaters.

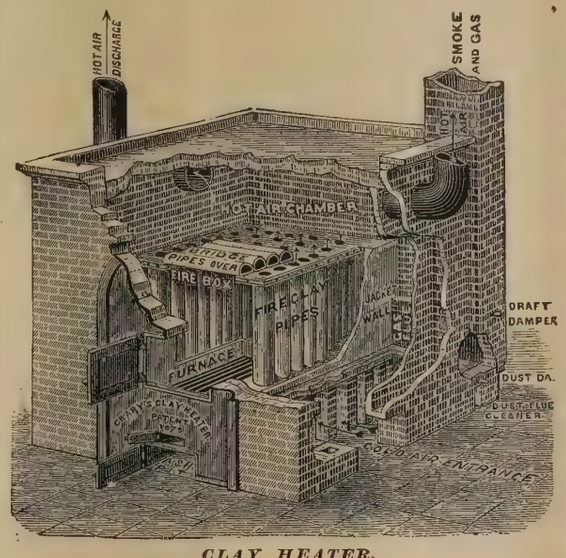
We believe that at present it is generally acknowledged that the use of iron for heating with hot air has been unsatisfactory, and it is thought to have helped the increase of pulmonary and typhoid diseases. This has resulted in the abandonment of iron heaters, and the adoption of expensive steam and hot-water apparatus, which, in the absence of anything better, has given more or less satisfaction. Iron, when heated above the boiling point of water, is subject to that interpenetration of gases called endosmose and exosmose; when carbonic acid and carbonic oxid gases are at one side of a hot iron plate and air at the other side, an interchange will take place, and the hot gases named, which are the products of the combustion of the fuel in the furnace, will not only allow their heat to pass through the iron, but a small quantity of them will bodily pass through the same, in exchange for atmospheric oxygen, which will enter, so that air heated in this way has become poorer in oxygen, while the small quantity of carbonic oxid present in air will have increased, sometimes very largely, and even traces of the injurious carbonic oxid may have become perceptible. To this must be added that the contact of a hot and easily oxidizable metal like iron destroys all traces of ozone in the air; ozone, which is nothing but a more active modification of atmospheric oxygen, is the most powerful disinfectant; traces are most always present in any wholesome, clear atmosphere, and are only absent when contagious diseases are raging, or in unwholesome, swampy localities. When it comes in contact with hot iron it is at once absorbed by the same and oxidizes it, so that air passing over an iron heater will have lost its ozone, some of its oxygen, have its carbonic acid increased, and may perhaps contain some of the poisonous carbonic oxid, in case the combustion in the furnace is imperfect from the want of sufficient draft.

The prevailing impression is that the cause of the disagreeable smell of such air heated by iron, is that it is only due to the comparative dryness resulting from the increased capacity of hot air for watery vapor, by which the same air, when heated, will attain the quality of much dryer air. In order to compensate for this a water tank is added, and the evaporation of the water it contains certainly remedies one evil—the comparative dryness; but watery vapor cannot compensate for the diminished oxygen, the absence of ozone, and the presence of the carbonic gases with which the air becomes contaminated—the air, in fact, has lost some of its vitalizing properties, which no process of watery evaporation can restore, but only disguise.

The substitution of baked clay for iron is a most important improvement, which is due to Mr. Crary, while Messrs. B. Kreischer & Sons, foot of Houston street, East River, New York, manufacture such heaters. The main condition in their preparation is to bake the clay at a temperature so as not to vitrify it by too great a heat, but bake it sufficiently to make it air tight, while a certain degree of porosity admits of endosmose and exosmose, but of a more beneficial nature than is the case with the similar action of iron. In the first place the clay has no affinity for oxygen, so that it cannot oxidize either at a high or low temperature, therefore it will not rob the air of its oxygen or ozone, while it is permeable for watery vapor, but not for carbonic acid or oxid. Our fuels, consisting of carbon and hydrogen, their combustion, that is, combination with oxygen, produces from the carbon, carbonic acid, and from the hydrogen watery vapor. Now the main difference between hot iron and hot clay, is that while the iron allows the carbonic acid to permeate, the hot clay only admits the watery vapor to permeate, so that the difference in the use of the two substances is that iron increases the carbonic acid, decreases the oxygen, and increases the capacity of the air for water, and makes it comparatively dryer; while clay does not increase the carbonic acid, nor decrease the amount of oxygen, but adds to the moisture, so that the air remains moist and wholesome, while the contact of the hot clay has a purifying effect as regards the destruction of animal and vegetable poisonous germs the air may contain.

It is well known that clay and earth are the most effective deodorizers, and this is especially due to the alumina in the clay, which is a most powerful antiseptic, so that in all respects baked clay is the material *par excellence* which should be universally introduced for furnaces built for the combined purpose of ventilating and warming buildings with hot air, being in all respects superior to any other arrangement, not excepting steam coils.

The Crary clay heater, represented in the adjoined engraving, is constructed of vertical fire-clay pipes, with square flanges at top and bottom, which, when placed together with fire cement, leave enough space for the fire to circulate freely around the pipes, the flanges of which form at the same time the top and bottom of the combustion chamber, bottom of the hot-air chamber, and top of the cold-air chamber. The fire-box, as shown in the figure, is covered with half-round pipes, all joints filled with fire-clay cement, and the entire bottom of the hot-air chamber is covered with the same. A jacket wall is then placed around the pipes, to confine the fire to the combustion chamber, altogether forming a mass of hot clay, through which the products of combustion cannot pass without being consumed; thus, while the fire passes around the pipes, it does not in any way come in contact with the air that passes through them, the air being admitted from under the same, and heated in its passage to the hot-air chamber. The pressure of the cold air passing through the pipes being greater than that of the gases surrounding them, gas cannot get into the hot-air chamber, but only pure air.



CLAY HEATER.

Perfect combustion cannot take place in many of the ordinary iron heaters, because the channels for the escape of the products of combustion are generally too narrow, so that they are forced through the inside of the pipes and drums, which, by the rapid radiation of heat, are partially kept cold, the unconsumed parts of the fuel forming soot, or passing off with escaping gases; at the same time the gas will find the least outlet through the joints of the pipes and drums into the hot-air chamber, while with the clay heater the whole action of fire and gas is reversed. It is evident, therefore, that these clay heaters will keep the occupants of a house free from the "malaise" experienced in rooms heated either by iron stoves or hot air in contact with hot iron.

The manufacturer claims that if a person remained one full hour in a room heated to 140° Fah. by means of a clay stove, he will perspire abundantly, get a good appetite, but feel no sickness whatever; but the experiment, when performed for only half an hour with an iron stove, will bring on intense headache and sickness; that plants will wither and animals die if subjected for a long time to iron heat; children and grown people will lose their healthy color and their vital activity when breathing decomposed and impoverished air generated by iron or metal, while in air heated by clay, plants and animals grow and prosper; that diseases of the throat, respiratory organs and lungs will be prevented, ameliorated and cured (if not too far advanced) by inhaling atmospheric air heated by contact with hot clay, while air heated by contact with iron will increase and nourish such diseases.

There is no doubt that air in which plants grow and bloom can never be dangerous to human or animal life, while the reverse is just as positive.

In closing we call attention to the fact that, unlike heating with steam coils, in this system ventilation is combined with heating, as instead of merely heating the air already in the room, fresh, pure and warm air is continually admitted.

How Coffee is Adulterated.

Professor S. P. Sharples, the State Assayer of Massachusetts, is making some analyses of articles of food, which are resulting in interesting disclosures. Packages of coffee have engaged his attention, but he has found very few traces of the berry itself. The following are some of the results of his examination:

"Hayward & Co.'s French Breakfast Coffee," the label of which sets forth that only three-quarters as much of it need be used as would be required if ordinary coffee was employed, is found to contain no coffee at all, but to be made of green peas, burnt molasses, and "an occasional grain of rye."

A package of "Pure Roasted and Ground Cape Coffee" was found to be made wholly of peas and nut shells, the latter floating when the mixture was put in water.

A package of "Kimball's First Quality Mocha and Java Coffee" contained no coffee at all, but consisted of peas and rye.

"Glinee's Extra Quality French Coffee" was almost destitute of any foreigh substance, peas and rye predominating, with a few oats.

"Chase's English Breakfast Coffee" is a large consumer of peas, the traces of coffee being so slight that the assayer pronounced them accidental.

Happily the analyses have not disclosed the presence of any positively injurious substance, and if people, who can easily find out the cost of a pound of green coffee, expect to buy a like quantity roasted and ground for half the price, they deserve to drink weak pea soup. To detect adulterations, the following rules are given: Take some cold water in a glass and throw upon it about half a teaspoonful of the coffee to be tested, stirring it around so as to wet the grains. Pure coffee will float and scarcely color the water. Beans and chiccory sink to the bottom; chiccory colors the water at once, beans more slowly. Test the part that floats by chewing it; coffee will thus be recognized by its taste; nut shells, which also float, are hard and brittle. A species of nut which has lately come into use, strongly resembles coffee when ground up, by floating on the water as well as by its feeling between the teeth; but the difference can easily be detected, because the adulterating ingredient is nearly tasteless. After subjecting the suspected article to the above test, spread some of it on a sheet of paper and examine it carefully for grains of rye, oats and peas. The pea ingredient will frequently be found in pieces one-eighth its original size, and the rye in half grains; chiccory is tough when taken between the teeth, and has a bitter taste, different from the bitter coffee.

As to the roasted peas and rye which are sold instead of coffee, it is pretty certain that they are more

wholesome than the fruit of the coffee plant, being destitute of any narcotic quality; but the thing is a fraud, and it would be better for families—cheaper at least—to roast their own peas and make their own weak pea soup. As to chiccory, it is well known that at the restaurants in Paris and other French cities, all the coffee served to customers is largely adulterated with the roasted root of that plant, which is cultivated for that purpose, and much more wholesome than coffee.

The Latest Additions to New York Architecture.

Two remarkable buildings have recently been completed in New York, both intended to be rented out for offices; one is the Boreel building, near Trinity Church on Broadway, and the other is the Morse building, corner of Beekman and Nassau streets, opposite the rear of our office. Both buildings are ten stories high, the different floors being reached by elevators, and both possess the merit of such a very judicious distribution of space that all the rooms are splendidly lighted. The Boreel building has the advantage in standing isolated, with its four walls fronting on streets, while the Morse building stands on the corner of a block, and has only two fronts; then the former building is 100×150 feet, while the latter is only 70×85 feet. The conditions being so much in favor of the Boreel building, it is quite natural that the able architect succeeded in making a more imposing structure, especially in the interior, where an amount of architectural beauty and originality is displayed not equalled by any other similar structure in New York. The large size of the ground floor admitted of an open space in the interior, covered with a glass dome and surrounded by nine stories of corridors, leading to the various offices, which are reached by four elevators and four flights of staircases.

The conditions of the Morse building were similar to those of the *Tribune* building, only the architects of the Morse building, Messrs. Farnsworth and Silliman, have taken the very best advantage of these conditions, and solved the problem of erecting a ten-story brick building which is not an abortion, like the *Tribune* building, but one that is decidedly agreeable in its general appearance as well as in its details. The cause of this is the fine form of the many windows and the judicious use of black and molded bricks in the walls, while the effect of the whole is harmonious and chaste.

The only criticism made by some is that the roof is flat, or rather that no roof is visible. Some architects are of the opinion that a building of that hight ought to show a roof; but then if the roof were high in proportion to the hight of the building, many would consider it extravagantly high, as is really the case with the abominable roof of the *Tribune* building, while a low roof would certainly be criticised as inappropriate. So we think that the architects did wisely in not showing the roof, which, in whatever shape or size it might have been constructed, would certainly have been the subject of severe criticism.

In support of our opinion we point to the *Evening Post* building, corner of Broadway and Fulton street, which, with its roof, is nothing but a confused jumble of building material; and then we point to the Trinity building, erected some twenty-five years ago by the late Mr. Upjohn, which, without making any pretension to architectural display, looks at least respectable.

Manhattan Beach.

The New York and Manhattan Beach Railroad Co., running from Greenpoint to the Manhattan Beach Hotel, will open for the season of 1879 on the 14th of June, and the most complete arrangements have been made for the enjoyment and comfort of excusionists.

We have been sent a long programme embracing the chief attractions at this beach, and certainly no one can complain of lack of accommodations or diversions. The programme referred to contains descriptive reference to fourteen of the principal features to be found at this far-famed summer resort: 1st, there is the grand hotel, the largest of its kind in the world—fronting 660 feet on the ocean—a model of sea-side architecture, unsurpassed in its arrangements for the comfort and convenience of visitors; 2d, the Great Pavilion; 3d, the surf bathing; 4th, the ladies' bathing pavilion; 5th, the gentlemen's bathing pavilion; 6th, the amphitheater; 7th, the immense captive balloon; 8th, Gilmore's band; 9th, the far-famed "Levy"; 10th, the marine railway; 11th, the East End; 12th, the boat house and landing; 13th, 500 acres of sea beach; 14th, the wonderful electric lights.

Domestic Portland Cement Manufacture.

The Cobb Lime Company, of Rockland, Me., are about to begin the manufacture of Portland cement, and are now erecting works for that purpose. The works will include two mills for grinding the materials of which the cement is composed, and reducing it to a plastic state, the ovens and drying floors which are to convert it to a sufficient degree of hardness to be ready for transfer to the kilns, the kilns for burning the cement, a mill for grinding it, with the necessary sheds and conveniences for barrelling and shipping. The cement is manufactured from limestone and clay. The clay, of suitable quality, is close at hand, the banks against which the works are located being composed of it, below the surface layer of loam. In the process of manufacture the clay and limestone are ground together, issuing into tanks from which the resultant mixture flows in a plastic state upon the drying floor. The surface of this drying platform is composed of fire-brick or tiles, resting upon brick flues, through which the heat from the ovens circulates. Here the material is converted to about the consistency of the old-fashioned "ginger-bread." It is then ready for the kilns, where it is packed with coke in alternate layers and burned. The coke used is obtained from the coal used in the ovens, thus securing economy in the use of material. After the cement comes from the kilns, it is ground, sifted, barrelled, and is then ready for shipment.

This new enterprise promises to establish a profitable and important industry.

Zero.

It has been well and truthfully said that "a good refrigerator is a necessity in every household," and it would be equally true to add, "and there are few refrigerators to which the word good can be applied." It is easy to refrigerate; it can be done without a refrigerator at all, by a copious supply of ice. The great desideratum is to secure refrigeration with the least possible waste of ice, and without deterioration of goods; and in one or the other, and often in both these points, the majority of those now in use are defective. Mr. A. M. Lesley, of 372 Sixth avenue, New York, in the Zero Refrigerator, has secured both these objects, and if practical tests, the endorsement of hundreds who have bought them, and the decisions of experts at the great Centennial Exposition, and on numerous other similar occasions, have any merit in them, it leaves nothing to be desired. There are over 36,000 now in use, and all agree that it is the *ne plus ultra* of refrigerating success for family purposes.

Miscellaneous and Advertising.

New Patent Paper Boxes as applied to all wrapping purposes. Send for sample, stating size, to Wm. Meschenmoser, 120 William street, New York.

JUST PUBLISHED, "A Complete History of the Steam Engine," 450 pages, 163 illustrations, and 15 portraits. Price by mail, $2.50. Send for circular. Frederick Keppy, Scientific Book Publisher, Bridgeport, Conn.

When Frank & Co., of Buffalo, N. Y., produced a scroll saw combining all the essentials of a first-class machine for $65, they met a want that had long existed, and they deserve the thanks of all wood-workers for bringing such a low-priced saw on the market. The machine is built in the most thorough and substantial manner, makes from 1,000 to 1,200 revolutions per minute, and gives the very best results.

Simplicity, reliability and durability are certainly the most essential requisites a steam pump can possess, and these qualities are to be found in the National Steam Pump, manufactured by William E. Kelly, of New Brunswick, N. J. This pump is adapted for every possible duty, and is performing excellent work in localities where it is being employed. The manufacturer has issued a reduced price-list, which will be furnished on application.

Barrel manufacturers, in order to compete with their rivals, must of necessity adopt the successive improvements in the machines used in this industry. John Greenwood & Co., of Rochester, N. Y., who are the foremost makers of this class of machines in the world, have attained extraordinary perfection in their many novel devices, and to their enterprise and ingenuity is due in no small degree the present high state of this branch of manufacture.

Mr. W. B. Adams, one of the most extensive contractors and decorators in this city, says he has used nearly fifty thousand gallons of H. W. Johns' Liquid Paints, and after an experience of twenty years with white lead and other paints, he considers H. W. Johns' Asbestos Paints not only superior in richness of color and durability, but, owing to their wonderful covering properties, they are fully twenty per cent more economical than any others.

Design for Cheap Dwelling.

The elevations and plans on the opposite page were executed by Mr. James W. Pirsson, architect, of 56 Wall and 59 Pine streets, New York, and represent a design for a cheap dwelling. Several houses were built after these plans, but with varied elevations, at Kearney, near East Newark, N. J. They were intended for very cheap houses, and cost at that time (some three years ago) between $1,200 and $1,300 each; but the design could now be carried out, in any place having the usual facilities for building, for from $1,100 to $1,150.

There is a cellar under the whole house, 6½ feet high, with a concrete floor, well lighted and ventilated. On the first floor, which is 9 feet high in the clear, there is a parlor 12×15 feet; dining-room, 12×15 feet; and kitchen, 11.6×12 feet, with closets. The stairs run up between the partitions, thus avoiding the expense of hand-rail and newels, which are quite an item among the many small things which go to make up the cost of a house. It will be seen that the hall, though not large, appears quite spacious by reason of its shape and arrangement.

On the second floor are three bedrooms, 12×15 feet, 11.6×12 feet, and 9×15 feet respectively. The ceilings in these rooms are to be 8 feet 6 inches high in the clear.

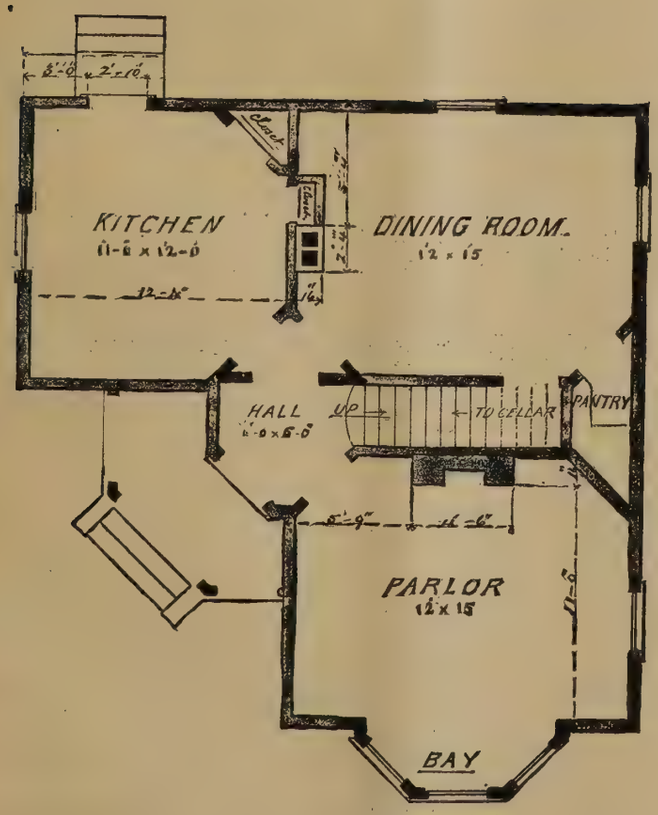
The house is of wood, balloon frame, planked with rough hemlock boards, placed diagonally for strength, and clapboarded outside, as shown in the elevations. Between the clapboards and rough planks it is to be sheathed with building paper, which is not only more air-tight, but much lighter and cheaper than filling in between the studs with brick. The roof to be of shingles. Cornices, bay-windows, piazza, etc., and weather-boards are all to be of clear white pine. The doors, 1¼ inches thick, with neat trimmings. In the parlor there is to be a plain but neat marble mantel.

This house, when tastefully painted, presents a very pretty appearance, and really looks as if it might have cost double the money, and its interior arrangements are not only very convenient, but give a home-like and comfortable aspect seldom obtained in so small a cottage.

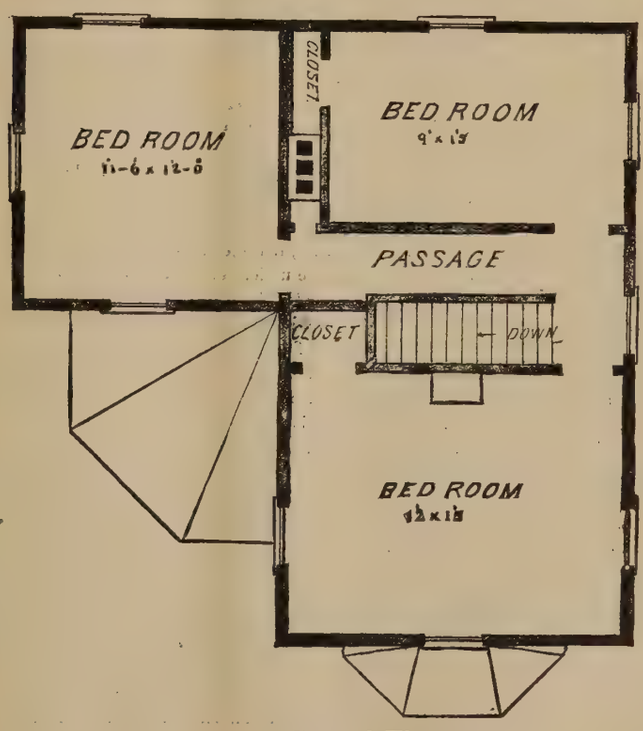
FRONT ELEVATION.

SIDE ELEVATION.

Scale—⅛ Inch to the Foot.



First Floor.



Second Floor.

DESIGN FOR CHEAP DWELLING.

Cost of Construction, $1,100 to $1,150.

The Coney Island Pier.

The contractors of the iron pier at West Brighton, Coney Island, are the Delaware Bridge Company, and the construction is under the supervision of Messrs. Maclay & Davies, civil engineers. The pier, when completed, is to be 1,000 feet in length, extending outward from high-water mark; its width is to be 50 feet, with enlargements of 100 feet in width at the shore end, the center, and the pier head. It is to be double decked, with iron substructure, the whole supported by wrought-iron tubular poles 9 inches in diameter, made of ½-inch metal. These piles are arranged in rows, at distances at 20 feet longitudinally and 16 feet 8 inches laterally. Each pile has at its base a circular cast-iron disk 2½ feet in diameter, which, when sunk into the sand, acts as a supporting base, and at the depth of 15 or 20 feet insures a perfect foundation. The piles are driven by the "jet water" system.

Iron capitals are bolted to the tops of the piles, and they support 15-inch wrought-iron beams, bolted together, upon which the superstructure will rest. The entire structure is to be made more secure by being braced throughout with diagonal rods 1½ inches in diameter, and heavy horizontal struts bolted to the beams transversely. When completed, the entire structure will be supported by 260 iron pillars. The flooring of the lower deck will be well finished and inclosed in a handsome iron railing. The landing stage will be at the lower deck of the pier-head, and will be guarded by massive oak fender pieces.

More than one hundred workmen are engaged in pushing the work forward. At night two Weston electric lights (one on shore and the other on the movable derrick) are used. The lights are from the establishment of the Weston Dynamo-Electric Machine Co., of Newark, N. J. The first pile was driven on the 22d of April. All the material for construction is on the ground, and it is intended to have the last pile in place by the first of this month. On the upper deck of the pier are to be spacious pavilions and saloons. The whole structure will cost over $150,000.

Wood-Carving as an Employment.

With the increase in the number of art schools in New York, it is surprising that as yet no efficient instruction in wood-carving is obtainable, although the art has made great progress in some sections of the country and met with general favor. In Cincinnati this industry has become of enough importance to call for a department in the School of Design, given to its special interest, and the work that the pupils, many of them amateurs, produce is of high market value. At St. Louis and Cleveland also, this art is well advanced, and there seems to be no reason for its not being followed with similar results in Eastern cities, if the conditions requisite to its full development are understood and submitted to. These can be appreciated best by a personal inquiry into the nature of wood-carving as an occupation, though it is quite evident at first thought that the slow, laborious effort with which skill in the art is acquired, is the main difficulty with which beginners have to contend. If, however, it be undertaken with a full appreciation of this fact, and without expectation of rapid attainment, the work finally accomplished seldom fails to compensate for the trouble taken. The form of genius needed in such work is the "power of infinite painstaking." Besides the popularity of this industry, and the multifarious forms to which it is adapted, there is another ground for its encouragement as one of the arts in which American schools may rise to eminence. It is an employment open to and peculiarly fitted for women. In European countries whole families, including the children, adopt it as a trade, and a visit to the hamlets and small villages of Switzerland, Bavaria, and parts of Germany and France, shows the occupants of almost every cottage busily engaged in producing innumerable trivial articles carved out of wood in the most artistic and dainty fashion. Skill and taste are required, though the amount of actual physical strength needed is scarcely appreciable, and women, quite as well as men, may engage in the pursuit. Skill and taste of course must be in a measure educated, and schools are indispensable. The ordinary rules of drawing, form and proportion, can no more be disregarded in this than any other art, and we would never advise any one to attempt to carve wood without taking some preparatory training by studying free-hand drawing, and, if the means are at command, drawing from the antique and the figure. If the carved work is intended for interior decoration, it also would be well to practice architectural drawing.

The inducements held out to women to follow this employment are unusual. It is remunerative, the field is comparatively open, and if any genius be developed, their work is apt to lead rapidly to fame, as the absurd notion prevailing a few years ago that feminine occupations end with the possibilities of the needle, no longer receives countenance, and the possibly incongruous character of the employment presents no objection to its adoption by women. Besides this, women who undertake wood-carving know that deficiencies in their work will not be condoned from any chivalric impulse, but that the time has come when the feeling is current that women's work and men's work are to be judged by the same standard, and that both need preparation. As needle-work, either plain or artistic, is a life effort if high excellence is sought, so other vocations must be adopted with the determination to follow them steadily. This is not only the soundest, but the most satisfactory course, for, to quote from a recent writer: "Women have learnt the lesson, or are rapidly learning it, that if they mean to live with even the least degree of comfort which will make life pleasant to them, much more if they are to live as they have been accustomed; and, above all, if life is to be to them something with interest and occupation, not a mere condition to be endured, they must find something to do, and they must learn to do that something really well and in a workmanlike fashion."

A Practical View of Scientific Exploring Expeditions.

The Boston *Commercial Bulletin* says: "We have received an illustrated paper from a scientific expedition which proposes to sail around the world in their own steamship. There is a beautiful illustration of the main saloon, an elegant apartment filled with handsomely dressed ladies and gentlemen, etc. But wait until these scientific chaps get well out to sea, and a stiff breeze and heavy swell gets up; all the science they will want is enough to strike the washbowl five times out of a possible fifty; they won't care whether there is any science or saloon or anything else aboard, and they will try weak brandy and water, and oatmeal and milk, and champagne and biscuit, and lemons, and hot whisky punch, at the time they ought to go to sleep and can't; but their stomachs, although conducted on the most scientific principles, will resolve themselves into quivering jellies. When they can crawl up and find that elegant saloon to be stuffy and bilgey, they will stagger out on deck and fall over sailors, and ropes, and deck chains, and other sea-sick people, and steering apparatus, and spars and things, and then they will exhaust their scientific knowledge in inventing scientific anathemas against the sea, and Christopher Columbus, and every other saline thing.

"But they have got to stay aboard their 'floating college' for 6 months. Before half the time is over every scientific man will be bored to death with every other scientific man, and long before the whole time has elapsed every scientist will regard his fellow with deadly hate, and will long for home and fresh oysters, and food that does not taste as if it had all been cooked in the same pan; and when they do return they will abjure science and the sea forever and till the soil, and if anybody says sea or science to them, they will cave in his head with a hoe."

New Publications.

The New Carpenter's and Builder's Assistant, and Wood-Worker's Guide. By Lucius D. Gould. New York: Bicknell & Comstock.

This publication is one of the rare instances where a book fills an existing want that has not already been supplied. All workmen of experience will testify that if they look in books for practical information, to find sections of pieces placed in different positions, to find how to cut all kinds of joints, how to find the form of a raking mold at any point divergent from a straight line, how to miter circular moldings, and many other practical problems, no existing book will give them the necessary information, except those containing the whole science of elementary and descriptive geometry; and even these give only the theoretical principles upon which the operations are based, leaving their practical application to the workman. In this book the author gives all the rules of this kind in so plain a manner as to be easily understood by the average workman. It also contains tables of weight and cohesive and crushing strength of different building materials, together with a treatise on the adhesion of nails, screws, pins, and glue, and an easy system of stair racking.

We regret, however, that the author adheres to the round-about rules for solving problems in regard to the circle, which he also published in some of his former books, and has not improved on.

The Strength of Materials. By William Kent, M. E. New York: D. Van Nostrand.

This is another and very important number of Van Nostrand's Science Series, and also a re-print from his "Engineering Magazine." The author says in the preface that he has become "profoundly impressed with the lamentable want of information, especially among manufacturers and users of materials of construction, concerning the proper methods of testing; and also with the lack of standard methods among professional engineers." We trust that notwithstanding the literature upon this subject is already extensive, this publication will be an important and influential contribution, as it exposes large discrepancies and shows what may be considered as incorrect tests. It points out the danger of relying upon published figures of strength, deprecates the habit of guess-work in important structures, and recommends the actual test of the material used.

Cameron's Plasterer's Manual. By K. Cameron. New York: Bicknell & Comstock.

This publication contains an illustrated description of all the tools and materials used by plasterers; an explanation of the appearance and action of every variety of lime and cement; instruction for making all kinds of mortar, and doing various kinds of plain and ornamental plastering, hydraulic plastering, cistern building, gravel walks, mastic cement, etc, forms of contracts, useful tables, recipes, etc.

The author does not claim that the business can be learned from his book alone, but that it is published in order to convey the information that many plasterers need, and as an aid to those young men who have engaged themselves as apprentices to master workmen, who will often be much benefitted by the information contained in this work. We highly recommend it to them.

Illustrated Lodge Catalogue of Chairs and Settees Mounted with Perforated Veneer. By Gardner & Co., 383 Canal street, New York.

This illustrated catalogue contains forty engravings, some of them beautifully colored, of the various kinds of chairs most adapted for the use of lodges, and most of them especially designed for the purpose of being further ornamented with emblems, names, or numbers. These styles of chairs are becoming the favorite for this purpose by reason of their solidity, durability, chaste appearance, and comparative low cost, while the more expensive upholstered chairs soon look faded. These chairs have been introduced in a number of lodges, including Charter Oak I. O. O. F., Pathagorus Hall, New York, and other places. We advise all interested to send for this catalogue.

PAMPHLETS RECEIVED.

"Additional Facts and Information in Relation to the Catalpa Tree. Catalpa Bignonioides and its Variety (?) Speciosa." Dayton, Ohio: E. E. Barney.

"Quarterly Report of the Chief of the Bureau of Statistics; Treasury Department, Relative to the Imports, Exports, Immigration, and Navigation of the United States, for the three months ended September 30, 1878; also containing other Statistics relative to the Trade and Industry of the Country." Washington: Government Printing Office.

"Programme for the Seventh Annual Exhibition of the Inter-State Industrial Exposition of Chicago." Chicago: The J. M. W. Jones Stationery and Printing Co.

'Official Bulletin of the International Exhibition, Fairmount Park, Philadelphia." Philadelphia: International Exhibition Company.

We are indebted to the American Institute of Mining Engineers for the following pamphlets: "On the Classification of Original Rocks," by Thomas Macfarlane, Wyandotte, Mich. "Note on the Determination of Silicon in Pig Iron and Steel," by Dr. Thomas M. Drown. "An Improved System of Cornish Pit-Work," by Ellsworth Daggett. "Phosphorus in Coal," by Andrew S. McCreath.

Notes and Queries.

This department is intended to furnish, for the benefit of all our readers, information on any subject of scientific or practical knowledge falling within the field of The Manufacturer and Builder. *All persons possessing additional or more correct information than that which we give relating to the questions, are cordially invited to communicate it to us for publication. We also request that all questions or answers be written on separate pieces of paper, and addressed to the Editor.*

QUESTIONS.

(2381) Making Asphaltum Roads.—I wish to make a road of asphaltum. Can you give me directions how to prepare it, put down, and the cost per foot?—W. H. B., N. J.

(2382) Details of Cars on Inclined Railroads.—Will you please inform me as to the style of seats used on such inclined railways as the Mount Washington and Mauch Chunk, and if they are made to adapt themselves to every change of grade? In coming down these steep grades what appliances are used to control the locomotive and cars? is it by brakes or otherwise?—M. L., Hamilton, Canada.

(2383) Largest Gun.—What is the largest gun thus far made?—Veteran Artillerist, Fort Hamilton, New York Bay.

(2384) Electro-Plating Porcelain.—Is there any way to make an electrotyping deposit on porcelain? What is the best conducting basis to put on for receiving the gilding in patterns?—M. F., Brooklyn, N. Y.

(2385) Is Glucose Candy Wholesome?—We use a great deal of grape sugar, or glucose, in our candies at present, and I want to know if it is in any way injurious to those who eat much of it. You know that sugar alone is rather too sweet; it must be diluted with something. In former times we used flour, starch, terra alba, and French chalk, but glucose appears to be just the thing, as it is not so sweet as common sugar. I only wish to know if it is hurtful, as I understand it is now made from corn, barley, etc., by means of mineral acids.—A Conscientious Confectioner, New York City.

(2386) Changing the Cut-Off.—In order to rectify the deficiencies in my inquiry, (No. 2367, page 119 of your May number), I will state that the engine is a Bookwalter, manufactured by James Leffel & Co., of Springfield, Ohio. The cut-off is a very common one, worked by a cam or collar; it is 4 inches in diameter, 3 inches of which are on one side of the shaft and 1 inch on the other side; it has a ⅝-inch stroke. The question is, would it lengthen the stroke to cut down the cam on the short side—the side having 1 inch from the shaft—and would the connection rod have to be lengthened or shortened. I am told by a person claiming to be a good engineer, that it would lengthen the stroke, and that the rod would not have to be changed. The longest side of the cam is not to be altered at all.—L. A. W., Mallet Creek, Ohio.

(2387) The Longest Bridge.—Some time ago you mentioned the longest bridge. I think it was in England. By the progress of railroad building this may have been surpassed; is this so or not?—D. D., Glendale, Pa.

(2388) Use of Gunpowder in Coal Mining.—Is gunpowder used for coal mining? If so, to what extent?—G. F., Jacksonville, Ga.

(2389) Correcting Alkaline Soils.—In some localities, especially in the West, the soil is so impregnated with alkali as to render it useless for farming purposes. Where mechanics are settled on such lands they have a patch for a garden adjoining the house they own; but it shows the alkali in the ground. Cannot this be corrected so as to make the ground adapted for vegetables, or at least flowers?—S. R., Johnsville, Ohio.

(2390) Browning Gun Barrels.—I have a gun from which all the browning has become removed. Not wishing to go to the expense of having it put on again, what can I do myself to make it look as before and protect it from rust?—G. M. A., Albion, Ill.

(2391) Cotton Mills in the South.—Can you give any information in regard to cotton mills in the South? It was reported some time ago that they were going to make their own cotton goods instead of sending the cotton North, and buying the manufactured goods from the Yankees. Is there any truth in this?—An Operative, Lowell, Mass.

(2392) Sticking Rubber to Wood.—Is there any substance that will stick wood and soft rubber together? Will ordinary glue do it?—L. M., New York City.

(2393) Undertakers' Books.—Are there any books on undertakers' work, giving drafts of different sized coffins, and the material used?—A Subscriber, Newport, Ky.

(2394) Machine for Sticking Moldings.—Are there any hand machines for sticking sash and small moldings? If so, where can I procure them?—A Subscriber, Newport, Ky.

(2395) Large Plate Glass.—I wish to represent a ghost on the stage in the best manner. Can I use two pieces of glass? or must I have only one piece? If so, please inform me what is the size of the largest piece of plate glass that can be procured? How large can it be obtained in New York, and at what cost?—C. R., Cincinnati, O.

(2396) Kaolin.—Being in the kaolin business, and wishing to obtain all the information on the subject possible, I take the liberty of asking a few questions. I wish to know something about the process of washing kaolin, the cost of washers, and the process; also the difference in the price of washed and unwashed.—H. M. P., Belleville, near Augusta, Ga.

(2397) Preparing Wood for Polish.—Please inform me how to prepare wood so as to make the polish or varnish look well on it.—L. F., Nicholas, W. Va.

(2398) Manufacture of Postal Cards.—Can you give me some information as to how and where postal cards are manufactured?—A. R., Rayville, La.

(2399) Making and Selling Telephones.—Can I manufacture and sell telephones in which a horseshoe or magnetic bar is used? or a piece of magnetized iron or steel? I have written to parties who manufactured and advertised telephones in your journal, operated by a magnet. I can get no answer from them. Have they been stopped by the large telephone companies?—T. W. S., New York City.

(2400) Distinguishing Iron and Steel Tools.—Can you tell me how I can distinguish between iron and steel tools?—C. M., Trenton, N. J.

(2401) First American Patents.—When did the American patent law come into operation by the granting of the first patent? How many inventions were patented in the beginning—say during the first ten years?—D. T., Fulton, N. Y.

(2402) To Prevent Corrosion.—I have difficulty in preventing the formation of corrosion on the small brass and copper parts of my engine. Can you tell me how to obviate this?—S. L. F., Beaver Falls, Minn.

(2403) Blackboard Paint.—Can you inform me how I can make a good paint for the blackboards in my school?—Schoolmaster, Trenton, N. J.

(2404) Making Inscriptions on Steel Tools.—How can I put my name on steel tools by the aid of chemicals? Which are the best? How is it done?—S. B., Brooklyn, N. Y.

(2405) Making Holes in Hard Steel.—Is there any chemical that will make a hole in a hard steel plate?—S. B., Brooklyn, N. Y.

REPLIES.

(2381) Making Asphaltum Roads.—The best thing for you would be to see such roads made—an operation of almost daily occurrence in New York city and vicinity. They have been laid down in several streets, but were most all failures, on account of the bad material used; the only good specimens are the sidewalks at the north side of the Post Office, and a short section in Fifth avenue, between 24th and 25th streets. The latter has been in use for many years, and only now begins to show the effect of wear by wagon wheels. In Central Park they keep well, being only used for foot paths, but some of them in that locality did not keep well at all, being made of coal tar pitch. In order to make such a pavement, you want a large cauldron and furnace to melt the asphaltum, and an apparatus for mixing it with sand and gravel; it is mixed until it has a pasty consistency, then laid on flat, and equalized by a heavy roller, sand being put over the pasty mass to prevent it sticking to the roller. The operation is easy enough, but the principal point is to first make a good sub-road, to give proper support to the asphaltum layer; this sub-road is best made by first grading the earth properly; if not sandy, sand must be put on top, and then it is best to place stones on the sand, with the flat side upward. In this way a hard sub-road is obtained. In regard to cost, this depends much on the material used; if you use coal tar pitch as a substitute for asphaltum, it will not cost you one-quarter as much as to buy good Swiss asphaltum from Val de Travers, which is the best for roads—in fact, it is equivalent to fusible stone; when cold, it is harder than limestone; when heated, it is soft and so plastic that it can be spread over the ground like mortar. Next to this is the Trinidad asphaltum, similar to what they call bitumen in Europe; it is much softer, purer, and possesses little or no earthy matter, which makes it less valuable for roads, being too soft. However, by mixing well with it a large quantity of dry sharp sand and fine pebbles, it may be utilized for making a good road, but it must be thoroughly mixed, because when not homogeneous it will wear out it spots and show holes in the road in a very short time. The advantage of the Val de Travers asphaltum is that it is already mixed, and this very uniformly, therefore it wears well. But you had best visit some city where they are making such roads, examine for yourself, and you will soon learn all you want to know. If you use a thick layer it will require more material than a thin one, and the cost may be made to vary from 2 to 10 cents per square foot, in proportion as you use a thin layer of coal tar pitch and expend the least possible amount of labor, or put on a thick layer of the best quality and spend much labor on the sub-road, etc. But we need not say that in this case, as in many others, the cheapest road will turn out to be the dearest in the end.

(2382) Details of Cars on Inclined Railroads.—The seats in the cars on the Mount Washington railroad are inclined, but fixed immovably; they do not adapt themselves to the change of grade, but their inclination is such as to be level when the car is on the average incline; where the incline of the road is less, the seat is found to be a little too much inclined; where the incline of the road is more, it is not quite enough inclined, but the differences are not sufficient to be inconvenient to the passengers, especially as in front of every seat a fixed foot bench has the same incline as the seat. On the Mauch Chunk railway the seats are along the sides of the car, as in the common horse cars; the door for exit is behind, while there is no provision at all for the incline, which is quite inconvenient for the passengers, especially for nervous people when looking out of the rear door down the steep incline of Mount Pisga. At Mauch Chunk the cars do not come down these steep inclines at all, but return by a roundabout way along a gradual incline, and their speed is regulated by ordinary brake arrangements. At Mount Washington the ascent is made by a cog wheel under the middle part of the locomotive, grasping into the teeth of a central rail, while an additional safety arrangement can be caused to grasp this central rail as well as the side rails, so that should anything give way the train can be stopped at any time. It is evident that a mere surface brake is insufficient on steep inclines, as gravity would cause the whole train to glide down like a sledge; but an arrangement for grasping the rails by clutches, acting on both sides of each rail, and also on the central rail, enables the engineer to keep perfect control of the train; these clutches are slightly released when descending, and are sufficient to stop the train at any point of the incline, so that the descent is perfectly safe. No accident has happened yet, except a stoppage of the train while ascending, made necessary by the giving out of the teeth of the cog wheel. At Mount Washington the locomotive has its boiler and smokestack inclined also, so as to correspond to the average grade, and to be respectively level and perpendicular when on the incline the full power of the engine is required; it pulls the train upward. At Mauch Chunk the cars are pushed upward by a small platform car, placed in the rear; this car is connected by a steel strap to the engine on the top of the hill, the strap running over rollers and passing under the train. At the base of the incline there is a depression between the rails, into which the small platform car descends; when the train arrives it runs over the platform car, and after having passed it the engine on the top of the mountain is started, pulls the small platform car forward, raising it along a short incline out of the depression between the rails; when it has reached the level of the track it runs against the rear car of the train, and pushes the latter upward. In order to make it possible for the car to descend between the rails of the track, so as to be out of the way of arriving trains, the whole car is made narrower than the gauge of the track, and the wheels slide outward, so as to fit as well on the main track as on the narrow gauge in the depression; when it arrives there, the wheels, provided with extra flanges, slide inward, so as to fit the narrow gauge. This small platform car is also provided with a safety arrangement, to be operated automatically when the steel strap breaks, or from any cause the pull ceases; as soon as this happens, side beams are thrown out, which imbed themselves in the earth next to the track, and render any descent of the car an utter impossibility. It is evident that a safety arrangement of this kind is absolutely necessary, as otherwise a rupture of the steel strap, or of its connections, resulting in the running down of a train with accelerating velocity on such an incline, would be of the most frightful consequences, as it would arrive at the base of the incline with a velocity far surpassing that of the swiftest railroad train, and knock itself, and everything it came in contact with, into thousands of splinters.

(2383) Largest Gun.—The largest gun thus far made was, until recently, the 14½-inch Krupp gun, tested last July with great success. This success has induced the making of a gun with a 16-inch bore, which has just been completed at the same works in Essen, Germany. The former weighed 50 tons, was 29 feet long, and threw a steel shell weighing 1,155 pounds, with a charge of 253 pounds of powder. The gun just finished weighs 70 tons, is 33 feet long, and throws a steel shell weighing 1,600 pounds, requiring a charge of 352 pounds of powder. The velocity imparted by both guns is the same, namely, 1,600 feet per second, thus faster than sound, which traverses only 1,100 feet in the same time, so that a man is hit by the ball before he hears the explosion, and if killed outright will not hear it at all. The former gun sent the shot through 24 inches of armor plating; what the new gun will do has yet to be learned.

(2384) Electro-Plating Porcelain.—An ethereal solution of chlorid of gold or of platinum is added to a syrupy solution of sulphur in oil of lavender spike, mixed and warmed. The compound is evaporated until as thick as paint, and then the porcelain is painted with it in figures, ornaments or lettering, as desired. The porcelain is then baked, which reduces the gold or platinum to its pure metallic condition. After baking, it is immersed in the electro-plating bath, and receives the deposit of any metal desired on the conducting design, provided these are brought into proper contact with the anode. This is the process at present extensively in use in France.

(2385) Is Glucose Candy Wholesome?—If our correspondent is really conscientious, he must give up the use of glucose in candies, or at least use it very sparingly. We know it will be a sacrifice, as glucose can now be had for from 3 to 4 cents a pound, while cane sugar costs about four times as much; but we are of the opinion that it is decidedly injurious, especially for those who have a tendency to dyspeptic sourness of the stomach, and this for the following reason: When cane sugar ferments, it changes first into grape sugar; it is the same with the starch in corn, wheat, barley, potatoes, etc., which, with the help of plenty of water and some heat, break up into dextrin and glucose—we say break up, as the fermentation is a destructive process, which in its gradual career of disorganization changes elaborate organic compounds into more simple ones. If the fermentation is stopped by drying the grape sugar it is the end of it for the time being, but if the grape sugar is again dissolved in water and properly diluted, fermentation will go on to a further stage, and the result will be alcohol or vinegar, according to the temperature; if this is kept down to about 50° Fah. alcoholic fermentation will take place, and every

molecule of grape sugar will be broken up into two molecules of alcohol and two molecules of carbonic acid; if the temperature is above 70° Fah., acetic fermentation will take place, and the grape sugar will be broken up into acetic acid, hence two kinds of fermentation are acknowledged by chemists—the alcoholic and the acetic. Brewers always want the first kind, as otherwise they would brew sour beer. This is why they use so much ice in summer; in olden times, before the use of ice was so common, they had to close their breweries during the summer, as they could not work—at least could not brew good beer. Now, in the human stomach the temperature is always above 70° Fah., and the conditions for acetic fermentation are favorable. If the digestion is vigorous the sugar is absorbed before fermentation takes place, and persons with strong digestive powers can often absorb grape sugar before it has time to ferment and become acid; but when the stomach is in the least weak or slow in its action, it has time for this, and sourness or dyspepsia is the result; such persons may be able to digest cane sugar, as this takes much longer to enter into acetic fermentation, as it must first turn into grape sugar or glucose. For these reasons it is not advisable to use grape sugar, and therefore we earnestly warn all persons troubled with weak digestion or sourness of the stomach to avoid the new fashioned candies, even if they are called "old-fashioned molasses candies." They are most all made of glucose, and nothing else. If you want sweets take a lump of good white or crystallized cane sugar, then you know what you are eating; but when you eat candies you do not.

(2386) Changing the Cut-Off.—By cutting off the short side of the cam the stroke will be lengthened. To secure an equal movement of the valve each way from the center, you must lengthen the rod one-half as much as you cut down the cam.

(2387) The Longest Bridge.—We consider that the longest bridge is the elevated railroad in Third avenue, New York city; it extends from the Battery to the Harlem river, the whole length of the eastern side of Manhattan Island—7 miles long or nearly 40,000 feet. If, however, you do not consider it a bridge, because it does not pass over water, then the longest bridge is the one now being constructed in Russia over the Volga, in Samaria, which will be nearly 4 miles long. The channel is nearly 5,000 feet wide, and over this the bridge will be supported by 12 piers, 364 feet apart, 85 feet high, and with ice cutters 35 feet high. The colony established for the 2,000 laborers employed at the shore occupies 55 acres, and has 60 buildings; 3 steamers and 70 barks are used for transporting material, while the cost is estimated at $3,500,000, or about half the amount already expended on the half-finished suspension bridge over the East River, between New York and Brooklyn.

(2388) Use of Gunpowder in Coal Mining.—The use of gunpowder is absolutely necessary in mining anthracite coal, and it has been found by comparing the production of anthracite with the amount of gunpowder used, that every pound of the latter exploded in the mine will liberate on an average a ton of coal. For the mining of soft bituminous coal little or no gunpowder is necessary.

(2389) Correcting Alkaline Soils.—The chief trouble is that the subsoil is a water-tight clay, so that the rain does not sink and carry the soluble alkalies and salts downward. The remedy is either to bore through this clay, so as to reach a porous layer below, which will give exit to the rain-water and all it holds in solution, or to make channels for drainage so that the rain-water can run off and carry the salt with it, which otherwise remains behind when the water is only disposed of by evaporation. Under such circumstances you never get rid of the salt. When in Holland a lake containing salt or brackish water has been drained by pumping, the bottom is always in the same condition as soil contains the salts of sea-water. This is remedied by constructing a system of ditches that will allow the rain-water to run off and carry it away with the excess of soluble salts in solution, and in two years the soil becomes fit for agriculture. If, however, the salts in your soil are merely alkaline, it may be corrected by watering with an exceedingly diluted mineral acid, such as sulphuric, phosphoric, or nitric, which perhaps is the best, when sulphates, phosphates, or nitrates will be formed, which, if not present in excess, are desirable in the soil. Stable manure is also good, as this, by decomposition, sets free such acids as will neutralize the alkalies.

(2390) Browning Gun Barrels.—Take 2 parts of chlorid of antimony, 2 of chlorid of iron, and 1 of gallic acid; dissolve in 4 parts of water. After cleaning the barrel well, apply the mixture with a sponge, and let it dry in the air; repeat this until the color is dark enough to suit you; finally wash off with water and dry the barrel, then rub it well with boiled linseed oil. The chlorids used should be as little acid as possible—that is, contain no free chlorin. In order to prevent this it is well to put into the solution a few small pieces of iron, say nails, and some metallic antimony, and let it stand over night.

(2391) Cotton Mills in the South.—Our correspondent does not appear to be well informed on this matter, as not less than 183 cotton mills have been built in the South since the war, while the number is continually increasing, and those already established are constantly being enlarged. We commend our Southern friends for their enterprise, and congratulate them on their success in this branch of industry.

(2392) Sticking Rubber to Wood.—Ordinary glue will not stick to soft rubber at all, therefore that will not do. In order to show you the usefulness of preserving the back numbers of the Manufacturer and Builder, and using them as a cyclopædia when information is wanted, the first volume we happen to take in hand is that of 1875; we look in the index, and find the item: "Cement for Uniting Metal, Wood, and Rubber, page 182." to which we turn, and read there as follows: "Soak shellac in ten times its amount of strong liquid ammonia. It takes nearly a month to do it, but then a liquid will be obtained which, if applied to metal or wood, will adhere, and also to rubber, as it will soften its surface before drying, and so cause a strong adhesion to all. This cement is very valuable for making steam pipe connections having rubber washers or rings perfectly air-tight, a job in which often much difficulty and annoyance are experienced."

(2393) Undertakers' Books.—As far as we know there have been no special books published on the undertaking business; nor any hand-books for coffin makers. Nor have we ever heard of an undertakers' monthly magazine. No doubt such a journal might be useful; why should not undertakers have the same rights as doctors, who often furnish them customers, and have journals by the score. We suggest that some of our enterprising contemporaries who have published j urnals devoted to special trades, but which, on account of competition, they could not make a success, start an undertakers' and coffin dealers' weekly. It is a new field, without competition.

(2394) Machine for Sticking Moldings.—In our opinion it is with this as with picking cotton, we do not believe that any machine could stick moldings better and quicker than it can be done by hand. If we are mistaken, we invite those who know better to come forward, explain, and state where the machine can be procured.

(2395) Large Plate Glass.—Upon inquiry we find that the largest Belgian and French plate glass imported in New York, which can now be had is 96 by 170 inches, or 8 by 14 feet. The price is $150, therefore $1.34 per square foot. Smaller sizes cost much less per square foot, as the price increases with the increasing risk of damage, which is very great for large plates. Some years ago, when the ghost was represented at Wallack's theater in this city, the illusion was perfect, for the simple reason that a very large plate glass was used. When, later, other theaters imitated the performance, and for the sake of economy, used smaller plates of glass, the illusion was not so perfect, as some discovered how it was done. Finally, when Prof. Pepper, the inventor of the trick, came here from England to lecture and give illustrations by experiment, he took, for the sake of still greater economy, two pieces of plate glass, joined in the middle; this spoiled the illusion entirely, as the seam or joint showed that there was glass there, and every one found out at once how it was done. To make matters worse, the two pieces were not placed exactly in the same plane, so that the parts of the ghost as reflected by one glass, did not exactly correspond with the parts reflected by the other—they did not fit well together, and the two reflections formed what geologists would call a "fault." So our advice is to use one glass by all means, and let it be as large as you possibly can afford to obtain it.

(2396) Kaolin.—An article under this head, short, but to the point, and answering most of the questions asked by you, can be found on page 142 of our June number for 1877. In regard to the cost of apparatus and labor, this varies so greatly with the locality where the operations have to be performed, that it is utterly impossible to give an estimate without first visiting the locality and inquiring about the nature of the crude material, transportation, etc., the latter of which, being such a bulky and at the same time comparatively cheap material, is one of the principal items of expense.

(2397) Preparing Wood for Polish.—Walnut or similar woods are best finished with fine glass paper, No. 0; then color linseed oil with alkanet root and rub into the wood, and afterward let it stand for a time until the oil has thoroughly soaked in; then proceed to fill the pores with a composition of plaster of Paris, 3 parts; tallow, 1; and a little red polish. This is to be thoroughly worked until it is mixed and becomes a crumbly mass. It can be rubbed into the wood with a piece of rag, after which all the superfluous parts are removed, and the surface is ready for the final polish, which may be put on with a brush, or after the French method—with a tampon; in the latter case only shellac dissolved in alcohol is used. With the brush you can use any kind of varnish.

(2398) Manufacture of Postal Cards.—The postal cards now used in the United States are made by the Phototype Company, Holyoke, Mass. The cards are printed in sheets containing 40 each, two of Hoe's super-royal presses being used for the purpose; and after being "seasoned" for two or three days, they are taken to the "stripper," where each sheet passes between rollers armed with circular knives, which, operating precisely like a pair of scissors with a continuous cut, quickly divide it into four strips, each containing ten cards; these strips are next taken to the cross cutters, which, being fitted with circular knives like the stripper, divide them into single cards. Strip follows strip in rapid succession, and the cards drop one after the other into a revolving receptacle or hopper, which, being turned as soon as twenty-five strips have been fed through the machine, brings an empty hopper into position for catching a new lot of cards, and at the same time brings those previously cut within reach of the banders. Each machine keeps three women, besides the feeder, occupied, whose duty it is to recount and assort, throwing out all dirty or torn cards, press marks or miscuts, and to band the cards in packages of twenty-five. It requires nimble fingers to do the work in a proper manner. From the machines the cards go to the boxing tables, where they are carefully packed into pasteboard boxes, each containing twenty-five packs of five hundred cards. These boxes are in turn packed in wooden cases of various sizes, containing from 2,000 to 25,000 cards, ready for shipment to the post offices of the country. Many small offices order less than 2,000 cards at a time, and cards to fill such orders are shipped in packages, but larger amounts are always shipped in cases. All cards are sent by mail. The orders for cards vary greatly in quantity, according to the amount of business done at the different post offices. The number of cards now manufactured is nearly 250,000,000 per year, of which the New York post office takes about one-tenth, or 2,000,000 per month.

(2399) Making and Selling Telephones.—You can sell the bar or horseshoe magnet, and you can sell coils, but if you try to sell the same combined with a diaphragm of sheet iron, so as to use it for a telephone, you will certainly be prosecuted for infringement. The sheet-iron diaphragm is the principal feature of the patent, and the large telephone companies appear to be preparing to stop all infringers. We have never to our knowledge advertised a telephone operated by a magnet.

(2400) Distinguishing Iron and Steel Tools.—We find it stated in a contemporary that it is a difficult matter—that they have the same polish, the same workmanship, and that use alone can show the difference. It is recommended that in order to make the distinction quickly to place the tool upon a stone, and drop on it some dilute nitric acid, (four parts of water to one of acid). If the tool remains clean, it is of iron; while if of steel it will show a black spot where touched by the acid. These spots can easily be rubbed off. We must here remark that we never had much difficulty in making the detection; the polish of steel is most always more perfect than the polish of iron, because the harder a metal is the finer the polish it can be given, while the hardness is easily tested by a file, which we far prefer to a drop of acid. Usually, when we have no file at hand, we take our steel pocket-knife, and if the tool is good steel the point of the knife will not make any impression; if the tool is iron, or of a grade of steel softer than the steel the knife is made of, it will make a scratch; if the knife does not make a scratch, a file often will, as files are, as a rule, harder than cutting tools.

(2401) First American Patents.—The first patent was granted in 1790. If we are not mistaken, it was granted to Jacob Perkins for a nail forging machine—at least this invention was made in that same year. The number of inventions patented the first ten years was comparatively very small—no more than at present are granted every week, namely, 306 patents are recorded from 1790 to 1800.

(2402) To Prevent Corrosion.—Boil a large excess of so-called zinc dust for some time with a concentrated solution of caustic soda or potash, and place therein the articles to be coated. After a few minutes a mirror-like film of zinc will form upon them by the decomposition of the alkaline solution, in consequence of their electro-negative character in combination with the zinc. It is suggested that the process may also be used for forming a layer of tombac by heating a copper article thus coated carefully up to 248° to 284° Fah., (best under olive oil), when the zinc will unite with the copper supposed to form a gold-tinted tombac, and the articles need only be quickly cooled in water, or some other suitable liquid, as soon as the desired color is apparent.

(2403) Blackboard Paint.—The following is a good recipe: One quart of shellac dissolved in alcohol, 3 ounces of pulverized pumice stone, 2 ounces of pulverized rottenstone, and 4 ounces of lampblack; mix the last three ingredients together, moisten a portion at a time with a little of the shellac and alcohol, grind as thoroughly as possible with a knife or spatula, after which pour in the remainder of the alcohol, stirring often to prevent settling. One quart will furnish two coats for 80 square feet of blackboard not previously painted. The preparation dries immediately, and the board may be used within an hour if necessary. For further information we refer you to the answer to Query 1105, entitled "Liquid Slate for Blackboards," on page 264 of our November number for 1874.

(2404) Making Inscriptions on Steel Tools.—On the place you wish to make the inscription put melted wax or paraffin, and when cold cut with an instrument the letters or designs in the wax, cutting it through, so as to reach the metal. The neater you do this the neater the inscription will be, as every part of the metal exposed will become marked. Then make a little wax border around the name so as to prevent the liquid poured on from running off. This liquid may be nitric acid or aqua regia, which is a mixture of 1 part of nitric acid and 2 of hydrochloric acid. After a few minutes pour off the liquid and wash with water, then warm the tool to melt off the wax or paraffin.

(2405) Making Holes in Hard Steel.—Nitric acid will do it. To apply it cover the steel plate, at the place where you wish the hole, with a thick layer of melted wax; when cold, make a hole in the wax of the size you want the hole in the plate, then put on one or more drops of strong nitric acid, leave it on for some time, wash off with water, and if not eaten through, apply other drops of the same liquid, and continue this until the plate is perforated.

THE MANUFACTURER AND BUILDER.

Vol. XI.—No. 7. JULY, 1879. ELEVENTH YEAR.

Weston's Electric Light Generator.

Mr. Edward Weston, of Newark, N. J., who has earned a great reputation as the inventor and manufacturer of the dynamo-electric machine, now used in many electroplating and electrotyping establishments, both here and abroad, has for some time given his attention to the construction of a similar machine, especially adapted for the production of electric light, and of the lamps used in connection with the same. In the adjoined engravings Fig. 1 represents the machine, Fig. 2 the lamp exteriorly, Fig 3 another form of lamp, showing details of carbon carriers and of electro-magnet and armature regulating their position, and holding the sliding rod with a clamp, which automatically releases and keeps the light steady. This is one of Mr. Weston's latest improvements to the electric lamp. Fig. 4 represents the iron armature of Fig. 1, without its coils.

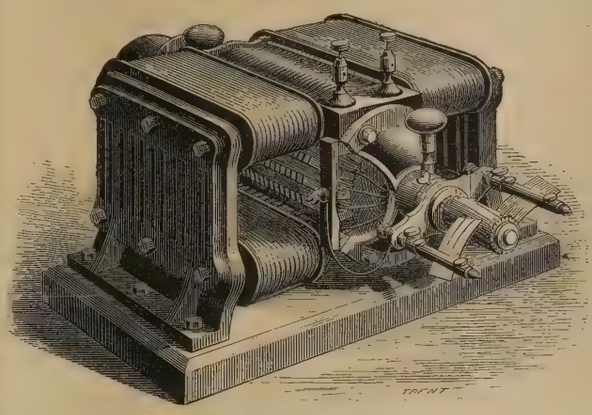


Fig. 1.—Weston's Electric Light Generator.

The machine (Fig. 1) is constructed with a view of keeping it in continuous operation without heating it to such a degree as to necessitate its stoppage so as to allow it to cool off, a feature in which many machines of this kind have failed. For this purpose the large stationary soft iron electro-magnets are, where they are not covered by the coils, perforated by slits. Fig. 1 shows these slits in the center of the top and on the sides, and when in motion the hand can feel the currents of air pass out of these slits, being propelled from the rotating center to the circumference by the centrifugal tendency, on the same principle as the action of a rotary fan blower. This continuous current of air, taken in cool at the center, and blowing out at the circumference, is most effective in keeping the machine cool, which, without this provision, loses much of its effectiveness, as the magnetic power of iron descends when the temperature rises, and the conductivity of the coils for electric currents diminishes from the same cause. Therefore, even if a machine does not become hot enough to necessitate its stoppage, it is of importance to keep its temperature at as low a degree as possible, so as to secure its maximum effectiveness.

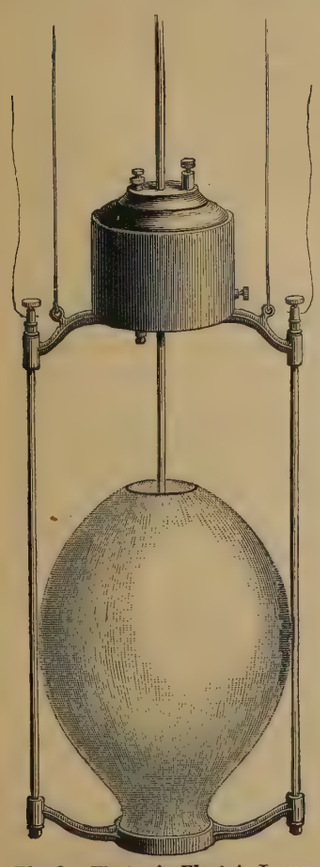


Fig. 2.—Weston's Electric Lamp.

The power required to drive these machines is from two to twelve horses, and depends on their size, of which the price varies from $200 to $1,200, the larger ones being capable of furnishing several lights. They are commencing to be largely used for brilliant illumination purposes in New York and vicinity, for instance, on the new iron pier at Coney Island, which we have described in a previous number.

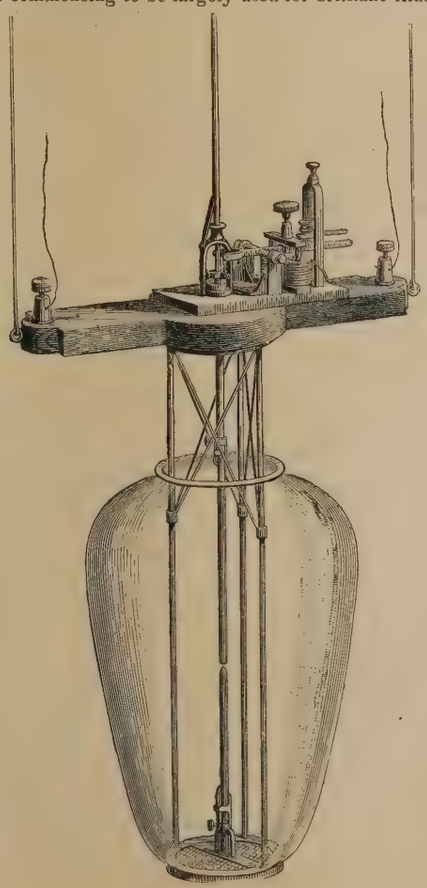


Fig. 3.—Details of Electric Lamp.

These machines excel in simplicity and compactness; they appear to be eminently durable, and are claimed to be the most powerful for their size and cost of any in the world, as it is reported that actual tests showed them to yield more than double the amount of light per horse-power absorbed than that obtained from any other machine built in this country.

The ability of the company to execute satisfactorily any orders for electric light, can be inferred from the fact that they have now in successful operation nearly seven hundred dynamo-electric machines among the largest manufacturers in this country and in Europe.

Figs. 2 and 3 represent lamps with ground glass globes, seen below, and which contain the carbons, the lower one being fixed to the bottom and the upper one suspended from the conducting rod, which is capable of sliding downward, but this down-sliding motion is arrested and regulated by a small clamp, worked by an electro-magnet, situated in the cylinder seen in Fig. 2, and its interior arrangement in Fig. 3; Fig. 4 shows the revolving armature, placed inside Fig. 1. The little electro-magnet in Fig. 3 is charged by the current; when its magnetism becomes too strong by a too close proximity of the two carbon electrodes, its attraction closes the clamp and draws the rod upward, separating the carbons. When the current, by this separation, suffers resistance enough to become weaker and cause the electro-magnet to relieve the armature by diminished attraction, it allows, by relieving the clamp, the rod to slide down and bring the carbons closer together. This simple device works so well that we have watched the light for hours and did not notice any perceptible change in it.

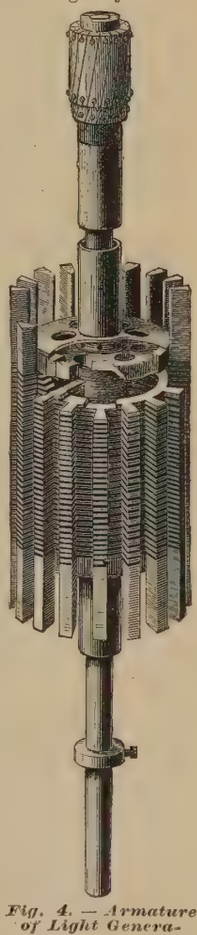


Fig. 4. — Armature of Light Generator.

We advise parties desiring the use of electric light, before ordering a machine, to communicate to the manufacturers full particulars in regard to the buildings and localities to be lighted, to give, for instance the size of the rooms or areas, the amount of power disposable, where it is located, etc. They can be sure that the manufacturers, the Weston Dynamo-Electric Machine Co., of 286 Washington street, Newark, N. J., will without delay give all particulars as to cost of machines, etc.

Messrs. Condit, Hanson & Van Winkle, the agents for the Weston Dynamo-Electric Machine Co.'s plating machinery, have opened an office at 92 and 94 Liberty street, New York, where information as to the light machine can also be obtained.

The Manufacturer and Builder.

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The Steel Industry in the United States.

England for many years had the monopoly of the manufacture of steel in the whole civilized world. The Sheffield steel defied in quality any competition. Our agricultural implements, tools, and cutlery required the constant importation of the English metal.

To Pittsburgh belongs the credit of having in the remarkably short space of sixteen years reversed the picture, and no industry perhaps in the entire United States has made such rapid progress. The steel now made here is more and more sought for in Europe, as the better quality of our material is more suitable for certain purposes. Manufacturers now invariably acknowledge that though their orders were to make tools from English steel, they will no longer submit to this prejudice, as tests have again and again proved that Pittsburgh steel is equally as good if not superior in quality. The very fact that such an abundance of it is made there now, and made fit to be used for rails as well as for the fine springs of clocks, is claimed as sufficient evidence that Pittsburgh has reached that eminence in steel manufacture which would enable this country to get along if there were not a pound of steel imported. The prejudice for the English material only keeps as yet the importation business alive, but day by day it is growing less. Our hammers, axes, saws, and in fact all our tools are now being made of American steel, and steel manufacturers are continually experimenting with still better ore, which they begin to draw in large quantities from North Carolina. That the prejudice in favor of English steel is baseless, was illustrated lately when complaint reached a Pittsburgh house that the steel they had delivered to a Western firm did not come up to the standard English make. They at once dispatched an expert to the spot, who went quietly to work and took the tickets or brands off all the steel and mixed the English with the American article. He then presented himself to the man in charge of the works, who had made the complaint, and he could not himself tell which was English or which American. It came out subsequently that the complainant was an Englishman, who has since, owing to this affair, lost a very prominent position.

In 1872 the manufacture of steel rails was begun in this country. Up to that time whatever steel rails were used here were imported. During that year, however, 94,000 tons of Bessemer steel rails were made here. In 1873, 129,000 tons were made; in 1874, 145,000 tons; in 1875, 300,000 tons; in 1876, 400,000 tons; in 1877, 420,000 tons; and in 1878, 500,000 tons. The United States has been making Bessemer steel rails only during eight years, while England, which has been for years engaged in this manufacture, makes to-day only 700,000 tons, or 200,000 tons more than this country is now making. The average value of a ton of Bessemer steel rails was $115 in 1872, and the average value to-day is about $42 per ton. When it is remembered that steel rails last from three to ten times longer than iron rails, and that the price per ton of iron rails is $34, it is not surprising that nearly all the railways, having any business at all, purchase steel rails.

An authority on all matters affecting the manufacture of steel, expresses the opinion that we are getting the rail manufacturing business in this country in such a condition now that it will enable us to export them. It will not be done from Pittsburgh, but from the mills accessible to the seaboard, like Troy, N. Y. The Ohio river is so uncertain the greater part of the year that it cannot be relied upon; but whenever the seaboard mills become engaged in the manufacture of rails for export it will also benefit Pittsburgh, as the home competition will then be somewhat less sharp.

This country is now making just as good a steel rail as England. True, our wages yet continue to make the cost of the article higher here. The actual price at the English works of a ton of steel rails at the present time is about $30, but we can work quicker than they can—an item not to be overlooked when we begin to compete in the neutral markets. With a pair of converters we can do as much here as they do abroad with three converters, simply owing to the new improvements we have made in the machinery.

There may be no export of steel rails this year, but the moment there is a general improvement in business in Europe as well as in this country, England will ask better prices for her rails and come closer up to us. They are not making any money there now; one house in England engaged in the manufacture of steel rails, lost in one year $375,000. It is their enormous capital that enables them to tide over such peculiar times, but they cannot always sell at a loss. We certainly cannot do so, and must wait until England's prices go up. American manufacturers also labor constantly under the disadvantage that all capital invested in manufacturing costs 8 per cent. Any improvement in business now must enable English manufacturers to pay higher wages, and by the time the price of their rails is nearly up to our prices, and we begin the contest with them in the neutral market, we will get ore suitable for Bessemer steel at lower figures than we have been getting it, either from West Virginia or Lake Superior. Already we are getting inquiries from South America for our steel rails. They are still using iron rails there, but they will soon change that system. The decline in prices from 1872 up to this year in this country, was not only caused by the general shrinkage, but also and principally by the greater capacity of this country to make the rails, the development of which has been very large.

What has been a great loss to the country at large, however, and is always seriously felt in the manufacturing districts, is the agitation of the tariff question. No man will enter upon an enterprise, no matter how small, when he cannot figure how he is to come out of it. It is far worse than a reduction of duty. Congress does not know the injury it has done the country already, and if it could be put down in figures the aggregate of loss caused by this agitation the exhibit would be frightful. The same old story, heard from Lowell to Cohoes and to Pittsburgh—that intense desire to be let alone by Congress and allow the commercial and manufacturing interests to work out their own salvation—is again and again repeated in the mammoth steel works of Pittsburgh. The machinery which has been placed in the mills and factories reflects the broad grasp with which capitalists there take in the volume of the country's needs and requirements. To repeat, however, the language of a Boston manufacturer: "With so much skill at its command the country will go ahead in spite of stupid legislation." These words are particularly appropriate when we look upon that complicated machinery which enables two boys, by the mere turning of a valve, to lift tons upon tons of metal. In the presence of such work there is no necessity to be over-sensitive as to what Congress does or does not enact.

The Ship Canal Across the American Isthmus.

On page 138 of our last issue we published an account of the route for a canal through the American continent, uniting the Atlantic and Pacific oceans, that was most favored by the United States as being nearest to us. Since that time the Congress of eminent engineers, gathered in Paris, has decided in favor of the plan always favored by De Lesseps—namely, a canal at the level of the oceans, and thus free and open without any locks. The only locality where this can be constructed with advantage is at Panama, the width of the isthmus being there the narrowest; but it necessitates the construction of a large tunnel, which, however, with our modern resources of engineering, is not a serious obstacle, and as the French nation, which successfully completed the Suez canal, will consider it a matter of national pride to construct this canal with the same success, its final completion is not a matter of doubt, notwithstanding the clamor of the English and some American papers, that without their active financial coöperation it will be impossible. We must not underrate the financial resources of France, which are far greater than they are supposed to be, either in England or in the United States, and amply sufficient to carry this plan through, as they were to complete the Suez canal.

A subscription announced in Paris, of a few million francs, intended to meet preliminary expenses for the Panama canal, was entirely filled the same day it was opened. This again proves that the support of the plan has become a matter of French national pride. In a recent lecture at Amiens, De Lesseps stated that the subscription for the great work itself would be opened two months hence, that in November he should himself start for the isthmus, that the first sod would be turned on New Year's Day, and with 30,000 or 40,000 navvies, some of them Chinese, but 15,000 of them free negroes from Brazil, whom the Emperor Dom Pedro would doubtless agree to send, the work would be completed in seven or eight years.

De Lesseps, the Engineer of the Panama Canal.

At the request of a correspondent, we give here a short biography of De Lesseps, the famous engineer of the Suez, and now of the Panama canal, which account we translate from the French paper *Figaro*.

De Lesseps' father was Count Mathieu de Lesseps, of Bayonne, and his mother was Spanish, and a cousin of the Montijos. His uncle, Barthelemy de Lesseps, embarked on La Perouse's ship, the "Astrolabe." La Perouse put him off on the coast of Kamtchatka, to carry home news of the expedition. The journey across Siberia was a fearful one, but it was a stroke of luck for De Lesseps, for the "Astrolabe" was never heard from again.

Ferdinand de Lesseps embraced a diplomatic career, like his father and uncle before him. He was made Envoy Extraordinary to Rome, but suddenly resigned one day because his views did not accord with those of the Assembly on some question. He wrote to his father: "I return to obscurity without regret." In his retirement De Lesseps developed his hobby—the Suez canal. The idea was an old one—as old as the Pharaohs, in fact—but it had been as often abandoned as projected. The history of this great work is known; De Lesseps went straight at it, and succeeded in an incredibly short space of time.

The English were very much opposed to the scheme, because they are always jealous of France. Lord Palmerston called De Lesseps "a sort of pickpocket." But this English abuse incensed the French, who rallied patriotically around De Lesseps. One day a venerable *bourgeois* came puffing up De Lesseps' three flights of stairs, and said, as he entered the room: "I want to subscribe to your railroad across the island of Sweden." "But," said De Lesseps, "it is not a railroad, it's a canal; it's not an island, but an isthmus; and it is not in Sweden, but at Suez." "I don't care what it is or where it is," said the capitalist, "so long as it makes England mad!"

When De Lesseps went to Egypt he was quite as much at home as he was at Paris. He was so unpopular at Cairo that the Khedive, who liked him, did not venture to invite him to audience, but said to him: "When you see me carry this big cane in public, come to see me in the evening." M. De Lesseps has the cane among his curiosities.

At last the work was done—at a cost of 400,000,000 francs. The inauguration was about taking place; six thousand official representatives of the civilized world were present; at the supreme moment, when the triumphal flotilla was about to sail the length of the canal, word was brought to De Lesseps that an Egyptian frigate, under English command, had grounded and blocked the way. An irremedial disaster; all Europe was there, and everybody would laugh at the canal and its projector. De Lesseps gave the order that the procession should pass the frigate, no matter how. The flotilla managed to squeeze by some way, and when the grounded frigate was passed she fired a salute in honor of France, adding greatly to the *éclat* of the occasion.

France gave De Lesseps the grand cordon of the Legion of Honor, and England, which had literally abused him like a pickpocket, sent him, in a massive golden casket, the freedom of the city of London—an honor shared by no Frenchman living.

De Lesseps is a small man, well built, but not thickset, though a trifle rounded in front; white hair, well combed, and parted with accuracy; an ordinary forehead; moustache a little less white than the hair; mouth very *vivante*; black eyelids; eyes black and full of the sun. He looks 55, although the civil record puts him down at 74. His exterior is very attractive; he is thinking entirely of his own ideas when he talks, although he listens with politeness to what others have to say.

When he was at the hight of his fame he married a very beautiful woman—Mlle. de Bragard. He was forty years older than she. He said to the editor of the *Figaro* that life without love was like a magic lantern without light. By his first wife he had two sons, who were his co-laborers in his great enterprise. By his present wife he has seven children, the youngest being about a year old. Assuredly, says the editor of the *Figaro*, M. de Lesseps was sent down here to be a creator.

Like an architect who reserves in a cathedral a niche for his own burial, M. de Lesseps has chosen a place on the banks of the Suez canal for his interment. It is not far from the sea, at a place where the canal makes a large mirror which reflects the flocks of birds of passage in their flight. These feathered voyagers of Africa swoop down to see themselves in the placid water, as women go out of their way to view the reflection of their forms in a shop glass. Over De Lesseps' tomb an Arabic inscription will tell how the black-eyed Frank made the ocean obey him as he would a dromedary.

The device of M. de Lesseps—*aperiam terram gentibus*—will also be written on his tomb. He hit upon this superb device in 1853, when he was crossing the desert now pierced by the canal. De Lesseps is one of the few men of the century who have been able to celebrate, while yet living, the realization of his dreams.

Financial Success of Artificial Ice.

It has long been a matter of doubt whether the artificial manufacture of ice can compete with nature's operations, which almost every winter manufactures ice on a most gigantic scale; and there is no doubt that in those climes where yearly a large ice crop is a certainty, and where the only expense is cutting and storage, no expensive artificial machinery can work with advantage; but when to the cost of cutting and storage is to be added the cost of distant transportation and the loss of material unavoidably connected with an article as unstable as ice is in summer, natural ice may in certain localities become quite expensive. Thus, in New Orleans it was formerly sold for from $20 to $30 a ton. The ice was delivered on the wharf in Boston for $3 a ton, it was then shipped and transported to the mouth of the Mississippi, towed 150 miles up the river, placed in ice houses in New Orleans, and finally delivered to customers. The loss amounted to 60 or 70 per cent, so that for 100 tons purchased only from 30 to 40 tons could be delivered; this, with the transportation expenses, made the average cost of the ice $16 per ton, so that a sale at $20 or $25, or even $30, according to circumstances, was considered nothing more than a legitimate profit.

Some ten years ago the first ice machines were introduced in New Orleans. The most successful at first was the ammonia machine of Carré; the machine was not so perfect, and much less economical, than this class of machines are at the present day, while the ice made by it cost $7 a ton. As the company (who had erected a large factory, running four machines made in Paris, each producing 10 tons a day) knew that the cost of Northern ice imported to New Orleans, was $16 per ton, they sold their ice for $15, and their success was sometimes good and sometimes bad, on account of some imperfections in the machines, which often produced a quality of ice not solid or hard enough. This happened with the first machines made; experience had not developed the weak points, and they became disarranged for the same reason that when the first locomotives were used on railroads, they were found to be unreliable—machine shops had to learn how to make reliable locomotives, and in the same way at the present day they have had to learn how to construct reliable ice-making machinery.

It appears that this has now been accomplished, especially with the class of machines that operate by making use of the heat absorbed when a volatile liquid is forcibly evaporated, or when a liquefiable gas, first liquefied by pressure, and the heat evolved abstracted by a current of cold water, is allowed to return to the gaseous state. When this takes place it demands a large amount of heat, which it seizes from all bodies in contact. If water is in contact, it is robbed of its heat and becomes frozen, and thus ice is formed.

In the first ammonia machines, such as those referred to and used in New Orleans, advantage was taken of the property of water to absorb ammoniacal gas, and in this way to relieve the mechanical part of the operation, as otherwise the whole of the liquefaction must be performed by pressure. It was at first supposed that this absorbing power of water was an advantage not to be neglected or lost, but experience has since proved that there are drawbacks connected with this method which more than annul the advantages gained, so that at present the ammonia machines are worked on exactly the same principle as those operating with ether, chymogene, or any other volatile liquid or condensable gas—namely, liquefaction by pressure and evaporation by a pressure pump. Thus, in the present style of ammonia machines about 50 pounds of liquid ammonia are stored in a very strong iron cylinder, and this is connected with a coil of pipes immersed in a tank of strong brine; into this brine galvanized iron cans, holding pure water, are placed, and these cans are of the size of the blocks of ice which are formed. The liquid ammonia is allowed to flow through these coils, and it gradually becomes gaseous, and in becoming so abstracts from the brine, and this from the water so much heat that it speedily freezes. A powerful steam pump forces the gaseous ammonia back into the iron cylinder again, thus liberating great heat, which is disposed of by cold water dropping upon coils of pipes through which ammonia passes on its way to the condenser. The process is a continuous one, and if the pumps and coils do not leak there is no loss, and the operation may go on so long as the machinery lasts.

Such a machine as above described is now in operation on the shore of the St. Johns river, Florida. It has been found capable of turning out 10 tons of ice daily, in the form of blocks about 2½ feet long and 10 inches thick. The congelation is perfect, and the product meets with a ready sale at the hotels and private residences, not only in Jacksonville, but at all the points on the St. Johns river. The price of Northern ice in Florida previous to the introduction of the machine, was from $15 to $20 a ton; the artificial ice is said to be sold at $5, and thus a powerful and successful competitor to the ice companies has sprung up at the door of their depositories. The dealers resisted and ridiculed the machine for some time, but in the end it triumphed, and prices were reduced. The actual cost of manufacturing ice in Florida is claimed to be from $1 to $2 a ton, including storage and delivery. It must be remembered, however, that fuel in Florida costs almost nothing; the ice company have only to haul the waste lumber from neighboring steam saw mills, and it is supplied without charge.

Humbug No. 3—Kiddle's.

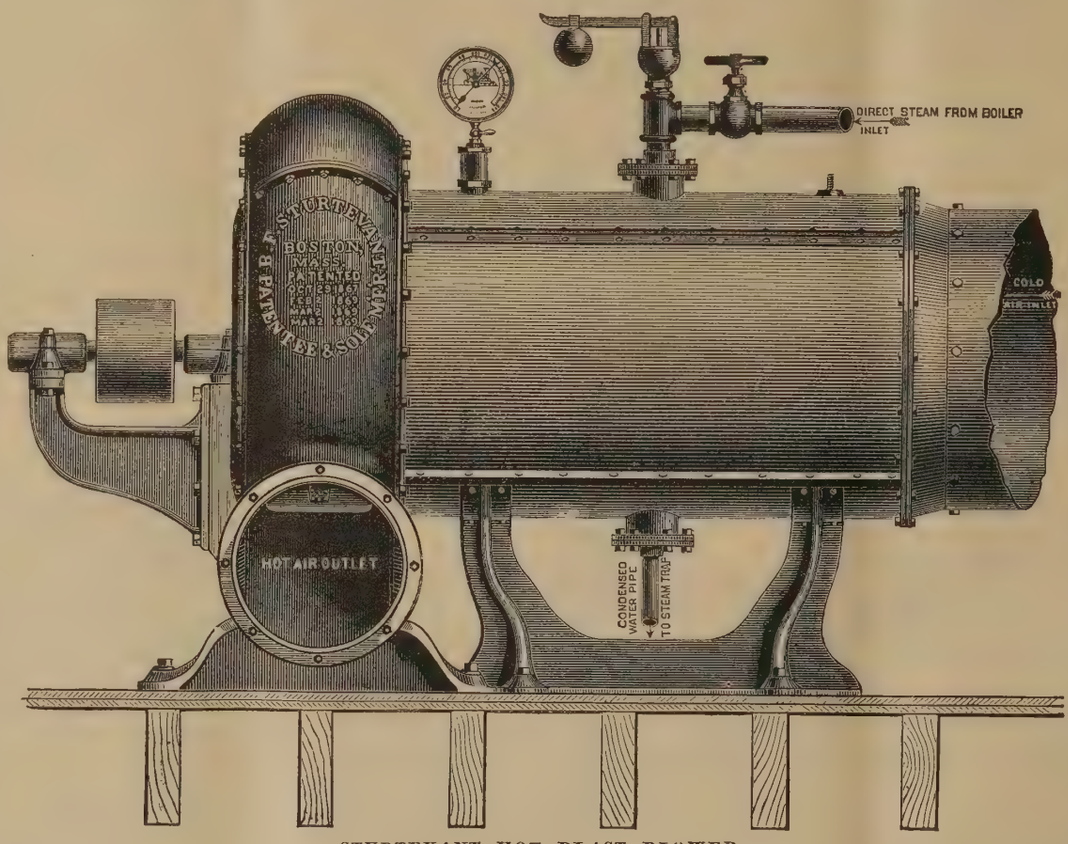
Mr. Henry Kiddle, who for fifteen years has occupied the position of Superintendent of Public Schools in New York city, and obtained an honorable name in that relation, has at last fallen from that estate and become the dupe of his own children. The latter, having received such a style of biblical education as to make them believe in spirits and spiritual communications, and having seen mediums and clairvoyants, at last became mediums themselves, and in that condition ventilated their crude ideas of heaven and hell, and personated the historical characters whose spirits are generally supposed to inhabit those regions.

The wonder is, not that Mr. Kiddle believes in Spiritualism, as this doctrine may be demonstrated from the Bible, but that he is so devoid of sound judgment and common sense as to believe that the pious slang, doggerel and twaddle asserted to be communicated by the spirits of Jim Fisk and St. Paul, Wm. M. Tweed and Shakespeare, Byron and Archbishop Hughes, Theodore Parker and Moses, Prince Albert and Pontius Pilate, etc., etc., are genuine revelations from these unholy and holy personages. The greatest wonder is that he is not ashamed to publish such trash. The communications he gives as coming from Shakespeare, Byron, and other noted personages, no more resemble their styles than the screech of an owl does the song of a nightingale. We say it is a wonder that he is not ashamed, as a man of his standing necessarily must know that the men quoted could not all talk in the same way, and all begin their spiritual communications in a style which reminds us very much of Sir Joseph Porter in "Pinafore"—"I am the monarch of the sea." One communication begins, "I am Pontius Pilate," etc.; another, "I am Moses," etc. Evidently the utterances originated with Mr. Kiddle's children, who, as the offspring of a Superintendent of Public Schools, ought at least to use better English than the stuff printed in the book. Mr. Kiddle never could have read Shakespeare intelligently, or he would have known that he could not have used such language as is here ascribed to him.

Hot Blast Blowers.

It is evident that for many operations a blast of hot air is not only preferable to cold air, but necessary. Such operations are chiefly for drying articles and seasoning lumber; and, seeing how many articles have to be dried and how much lumber to be seasoned, the want of a good hot blast apparatus needs only to be mentioned to be acknowledged.

Such an apparatus has lately been introduced by Mr. B. F. Sturtevant, of Boston, Mass., who has made himself famous, not only in this country, but abroad, for his excellent centrifugal blowers, the manufacture of which he has adopted as a specialty. To accomplish this, he has attached to his blower a drum, through which the air passes before it enters the rotary fan. The apparatus is represented in the adjoined engraving, which shows an exterior front view of the blower at the left, and the drum at the right and the center. The drum is provided with pipes, around which steam circulates, the live steam entering at the top and the condensed steam coming out below, from whence it returns to the boiler, as indicated in the figure, which also shows the pressure gauge and safety valve. It needs scarcely any further explanation, and we will only sum up the cases where such a hot blast apparatus can be used with advantage.



STURTEVANT HOT BLAST BLOWER.

It is very valuable in laundries for the rapid drying of clothes; in factories and dyeing establishments; for drying cotton, wool, hosiery, etc.; for the drying of leather, tobacco, corn, and all kinds of grain; for drying brick, pottery, porcelain, and any articles made of clay, in their process of manufacture. Then its value in the seasoning of lumber can hardly be over-estimated. All manufacturers who wish to season their lumber, so as to obtain reliable articles that will not warp or split, can do no better than submit the lumber they employ to the thorough drying process which this machine secures—such as piano makers, organ builders, carriage makers, and especially the makers of hubs, spokes, staves, and headings. Cabinet makers will find it to their advantage, if they have green lumber, as they can, by applying this process, make green lumber in a short time equivalent to lumber they have kept for more than a year in their shop, for the purpose of seasoning it in the ordinary way.

The heater is constructed entirely of steel and brass, in the most durable manner, while the rotary fan is of the latest and most approved pattern, displacing large columns of air, and being reversible, as a result of the form of the improved shape of the noiseless blast wheel. If the pipes are properly protected against cooling off, the hot blast can be carried many hundred feet. The blower separately can be attached to any convenient place of a hot air chamber heated by steam coils.

The temperature obtained by the air is from 150° to to 200°, never rising above the latter figure, which can only happen when the air is confined, steam coils being usually heated to 250° or 300°; but by the active circulation which the blower affords, the heat can never reach an undesirable degree. On the contrary, such an active and rapid circulation of air as this blower produces, would prevent the air from being sufficiently heated were not an extra contrivance provided to return the same air along the steam coils to the blower, so as not continually to waste the heat acquired, and to obtain the desired temperature mentioned; in this way a given amount of hot air has plenty of time to impart its heat to the lumber and absorb what little moisture there is before passing out of the dry-house. It may be supposed that the air, after having once passed through a pile of green lumber, or bed of wet wool or cotton, will have become thoroughly saturated with moisture, rendering it incapable of further use in drying. It has, however, been found by actual experiment that heated air will pass through the material to be dried many times before becoming thoroughly moistened—a dry sponge used for wiping off perspiration is a good illustration of the manner in which the air wipes off and absorbs the moisture from the substance being dried.

We need scarcely mention that Mr. Sturtevant has covered all the useful points of this apparatus with patents, while further information can be obtained by addressing him at 72 Sudbury street, Boston, Mass.

On a recent visit of inspection to the new steamer "Rynland," of Berlin, which had just arrived from Liverpool, where she was built, and belonging to the Red Line, for which Peter Wright & Co. are agents, we had the pleasure of seeing one of Sturtevant's blowers employed in supplying the blast to the boilers, and for ventilating the various compartments.

A NEW METHOD OF COLORING WOODS.—A German paper lately published the following directions for giving colors to woods: "The surface to be smeared with a strong solution of permanganate of potash, which is left on a longer or shorter time according to the shade required. The woody fiber decomposes the permanganate, precipitating protoxid of manganese, which is fixed in the fiber by the potash, set free. In most cases five minutes suffice for the operation. Cherry and pear-tree wood are most easily attacked, but a few experiments will serve to show the most favorable circumstances. When the action is excited the wood is carefully washed, dried, and afterwards polished in the ordinary way. The effect of this treatment on many woods is said to be surprising, particularly on cherry wood, to which a very beautiful reddish tone is communicated. The color is in all cases permanent in light and air.

Diseases of Trees.

Dr. James Brown, who has made the diseases of trees a special study, classifies them under: 1st, bark binding; 2d, lichen growth on the bark; 3d, stag-horn tops; 4th, scale; 5th, premature seeding; 6th, dropsy; 7th, ulcers; 8th, wounds; 9th, stunted growth; 10th, final decay. To these may be added the complaints of users of timber, which are excess of sap, doatiness, and weariness.

1st. Bark bound, means when the bark closes in such a way around the tree as to prevent the circulation of the sap and deposit of woody fiber, which always takes place between the bark and the outer layer of the wood. Longitudinal slits will remedy this, and may be as useful as horizontal slits are injurious.

2d. The lichens are caused by a derangement of the bark, which gives them a foothold. The remedy is to clean them off.

3d. Stag-horn topped is a derangement of willows and poplars, when growing in a soil too dry for them; and of elm, oak, and ash when the soil is too wet for them.

4th. Scale is a parasite, an insect very common on the young ash.

5th. Premature seeding means premature decay, and cannot be remedied; it is the result of unfavorable conditions surrounding a tree.

6th. Dropsy is the result of an excess of stagnant moisture and of fat soil. The roots absorb what the tree cannot assimilate, and swellings are the result. Improved drainage of the ground is the remedy.

7th. Ulcers are similar to dropsical swellings, but confined to corniferous trees. They are like running sores on men, and give exit to the natural juice, in the form of gum or resin.

8th. Wounds are accidents to the bark, and if extensive are always fatal to the life of a tree; if not extensive, and the tree otherwise sound, wounds will heal up, as they do in man.

9th. Stunted growth is a consequence of the natural law of the survival of the fittest. In a forest many young trees have to die, as there is not room for all that attempt to grow up.

10th. The final decay does for old tree what disease does for the young—it puts an end to their existence, as with man.

A revolution in practical metallurgy is pending. Prepare for startling developments and changes.

New Surface Planer, with Friction Feed.

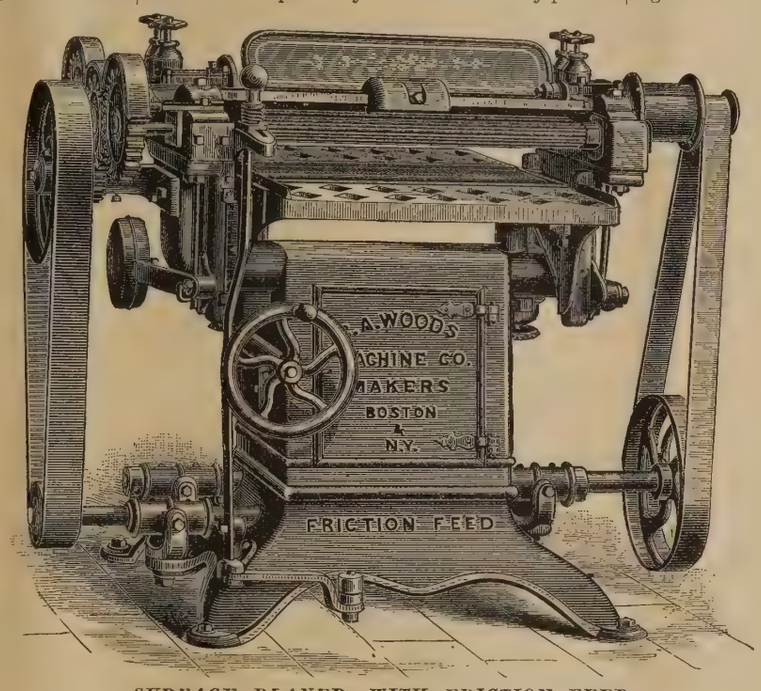
The new surface planer represented on this page, recommends itself by its compactness of design and strength, resulting from having a heavy frame cast in one piece, with a broad base, affording a firm support, although occupying but little room. At each side of the cylinder pressure bars are applied, the leading-in bar being hinged and weighted, allowing it to yield to inequalities in the surface of the lumber, while the two bars, being placed very near to the cut, enables pieces 6 inches or less in length to be planed with perfect facility.

An improved friction feed is applied, having two changes controlled by a single lever, dispensing with cone pulleys. The lever being moved in one direction produces the fast feed, and in the opposite direction the slow; when midway between the above the feed is stopped. These feed works are very strong and reliable, and cannot get out of order; their position in the hollow frame of the machine keeps them fully protected from dust and shavings, and renders the whole more compact and firm than when otherwise located.

The feed rolls, four in number, are made of cast-steel and strongly geared, two friction rolls being also placed in the table, directly under the first and last upper rolls. The broad bearing thus afforded holds the stuff firmly and prevents the clipping or chopping of the ends of the boards. A great cause of complaint with the small planers of other makers, has been the fault mentioned above, and the lack of feed power, both of which are entirely overcome in this machine. The leading-in rolls are fluted, and the carrying-out rolls are plain, the latter being protected by a shaving cap, and provided with steel scrapers to prevent them from marking the board.

The manufacturers, the S. A. Woods Machine Company, have made planing and molding machines a specialty for the last quarter of a century, and guarantee that this machine will give satisfaction, as it does in all the leading establishments where it is in use.

For further information apply to warerooms, 91 Liberty street, New York city; 172 High street, Boston, and 61 South Canal street, Chicago, where various other kinds of woodworking machinery can be seen.



SURFACE PLANER, WITH FRICTION FEED.

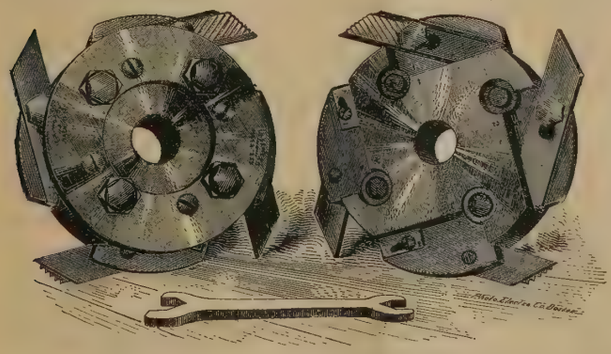
New Adjustable Dado and Grooving Head.

The important operation of grooving lumber requires well made tools, as the finish and value of many kinds of work depends upon well fitting grooves. On the introduction of grooving machinery a great deal of inferior work was turned out by reason of defective tools; but that time has passed, and now the machine-made grooving leaves nothing to be desired, especially when made by tools as perfect as those represented on this page, which are from the well and favorably known S. A. Woods Machine Company.

This grooving head is of simple construction, strongly made and accurately fitted; it is claimed to be superior to any other in its range of work, facility of adjustment, and ability to work a smoothly finished and accurate groove, either with or across the grain, and of any desired width from ¼ to 1 inch on the standard size. The cutters are secured in solid cast-steel blocks, which are moved independently of each other to any position across the head, by means of the screws and wrench shown in the engraving, without removing the head from the arbor. When the four cutters are in line, the narrowest groove is produced, other widths being obtained by setting them to one side, as desired, the position of each being shown by scales upon the head without need of special measurement and loss of time in trials to get the proper width. A tight or easy fit can be made without delay, and for dado work the two outer cutters are fitted with spurs, which insure a perfectly smooth cut upon the sides of the groove, without tearing out or bruising the edges.

No special fastenings or attachments are required, as the head can be used upon any ordinary saw arbor for grooving, gaining, rabbeting, tonguing, tenoning, or dado work with equally good results.

The usual or standard size works from ¼ to 1 inch wide, and has a hole for a 1-inch arbor. Other sizes may be ordered from the manufacturers at either of the addresses given in the preceding article.



Improved Adjustable Dado and Grooving Head.

Rest is Rust.

The opinion brought forward a few years ago at the yearly meeting of the American Association for the Advancement of Science, that the daily vibration of the iron rails on a railway was a preventive of rust, and which was debated and denied by some, has lately been practically confirmed in Germany on the Cologne-Mühlheim railroad.

A pile of rails of odd lengths were laid on sleepers over a bed of gravel, early in 1870, and remained undisturbed until the fall of 1877, there being no use for them. It was then found that they were covered with a layer of rust .12-inch thick, which had to be removed by striking the rail with a hammer. The cleaned rail weighed only 398.2 pounds, while its original weight was 419.1 pounds, showing that 5 per cent of the iron had been destroyed by rust, which covered the rail quite uniformly. The rails which had been in use during the same time had not lost half as much, notwithstanding the wear and tear of the trains moving over them. This confirms the observation that iron rails stacked away are much more liable to rust than those laid down in a track. Every carpenter knows that a tool out of use—such as a saw, for instance—loses more by rust than one continually in use, and subject to the consequent vibration, which appears to be a preventive of oxidation—at least to some extent.

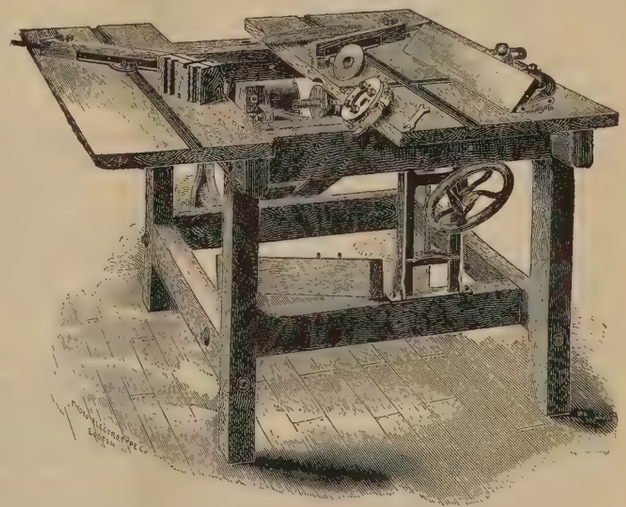
Improved Adjustable Saw Table.

The S. A. Woods Machine Company, present a new adjustable saw table to the public. The frame is either iron or wood, as desired; our engraving represents a table with a wooden frame, the other parts are all iron or steel. The arbor is of the very best cast-steel, and runs in a new style of self-oiling boxes, and is fitted up with a new improved self-centering bushing, which enables the automatically centering of saws with holes of different sizes.

By means of a hand wheel and screw the arbor, with its swinging frame, can be raised to any required position. This gives every facility for the use of grooving or dado heads without the possibility of a change of position when once set. An improved splitting guage is supplied, which can be set to cut any angle to 45°, while the two cross-cut slides allow stuff to be mitered to be worked on either side of the saw at any angle.

The top is made in two parts, one of which can be drawn out as shown in cut, when a larger top is required, or when using special heads or saws, while for ordinary use it can be closed in, to occupy less room. Suitable appliances retain this movable top in place in any position.

A counter-shaft is provided with table, without extra charge.



IMPROVED ADJUSTABLE SAW TABLE.

The Fine Japanese Cement is made by mixing rice flour with a sufficient quantity of cold water, then boiling gently, with constant stirring.

Wood-Working Machinery vs. Stover.

In the June number of the Manufacturer and Builder for 1877, we laid before our readers a very complete history of the operations of H. D. Stover—or the Boston Conductory Co.—and showed by unmistakable evidence the entire invalidity of their patent claims upon planing machinery. The article in question proved so clearly the illegality of his demands that Stover found he would either have to strengthen his claims or abandon the contest. The latter he was not willing to do; he therefore pursued the former alternative, and during the past year or more has coupled two or three points with his original claims. He is now travelling through the country with his pockets filled with papers to show where respectable firms have paid his demands or compromised, while the actual facts of the case are that these parties suffered his extortions rather than be annoyed by his persistent importunities, and not from any belief in the justice of his claims. The fact of his journeying from place to place with such settlements is therefore by no means a criterion that he has right on his side, or that other parties should be victimized.

We are credibly informed that Stover, after deceiving some parties of the very highest respectability in Ohio, and getting small sums of money as a compromise for his claims, called upon a party, who, subsequent to his departure, accidently came across a copy of our June number for 1877, and reading the facts of the case, was about having Stover arrested when he left town.

These particulars are interesting as a part of the history of one of the greatest patent extortions ever attempted, and we give them with the hope that others may take warning and resist his claims to the utmost.

The wood-working interest having requested the re-publication of the facts in the matter, as they were presented in the number above referred to, we herewith give the same, together with the illustrations, which show so clearly the points contested:

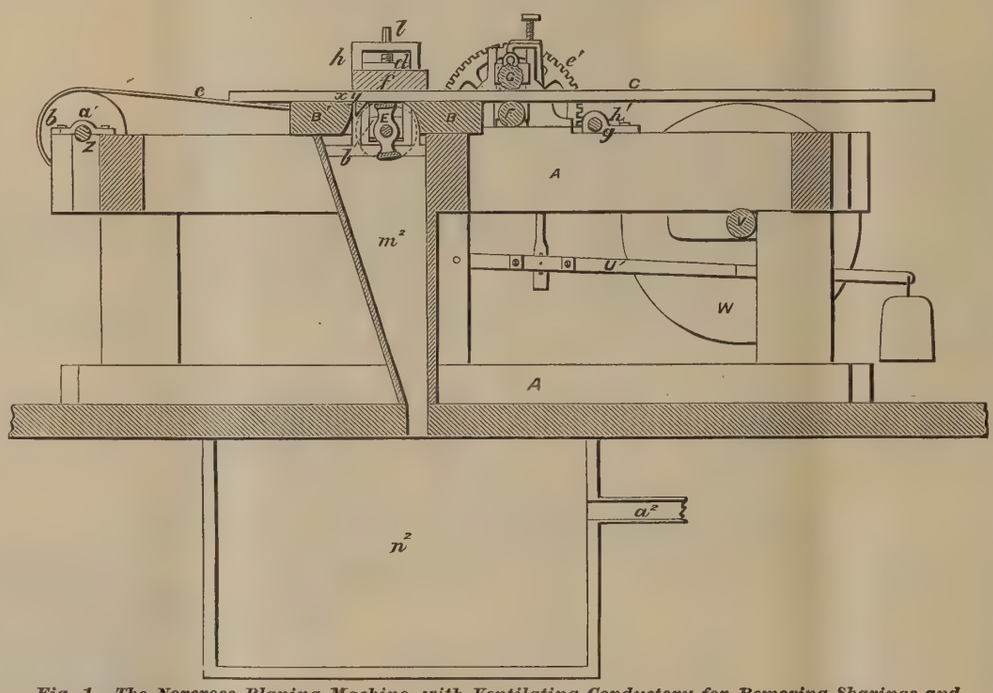


Fig. 1.—The Norcross Planing Machine, with Ventilating Conductory for Removing Shavings and Chips, Patented February 12, 1850.

The Boston Conductory Company—or H. D. Stover—professing to be the owners of the patent granted to H. D. Stover in December, 1860, upon planing machines, have for some time past been extorting various sums of money from the users of wood-working machines, claiming royalties, etc., for an alleged infringement of their patents. Many parties, rather than be annoyed with a threatened law suit, have submitted to their extortions, and have paid sums varying from $50 to $300, in order to be let alone.

During the fall of 1876, they brought suits against several prominent parties in Chicago for various amounts, which as yet have not been tried. The parties sued have formed an organization styled the Boston Conductory Defense Association, and have tried every means in their power to have the suits instigated by the Stover and Boston Conductory Company brought to trial, but as yet without avail.

Mr. B. F. Sturtevant, of Boston, has for several years endeavored to bring the matter to a test, using every means in his power to induce the Boston Conductory Company and Mr. Stover to bring a test suit against any of his customers, he being ready, and has been at all times, to defend any of his customers against the claims of the above parties.

We are indebted to Mr. I. R. Joslin, Vice-President of the S. A. Woods Machine Company, for some important points in regard to the asserted claims for the use of an exhaust fan and shaving conductor, and of some other details in wood-working machinery, while we are also indebted to Mr. C. W. Forbes (who was employed by Mr. Joslin as an expert to examine the patent records in Washington) for many other matters of importance embodied in the following paragraphs, which we recommend to the serious perusal of all parties interested. We may remark that Mr. Forbes has had large experience in the patent business, having been Examiner in the Patent Office for six years, and is therefore perfectly familiar with the patent laws, and is undoubtedly a competent and reliable expert in these matters.

The information which we are about to give for the especial benefit of those who intend to defend themselves against Mr. Stover's pretensions, would not be complete if we omitted to give the legal opinions on which Mr. Stover bases the prosecution of all who use any of the devices in question. These opinions, as will be seen, are of such a nature as may be obtained in almost any case when parties are interested in knowing only what is to their advantage, and intentionally ignore the other side of the question.

The first legal opinion brought forward by Mr. Stover, is that of Mr. George Gifford, who says substantially:

"I believe the claim to be good and valid, from the fact that the subject-matter of that claim, together with the subject-matter of the other claims in the patent having been three times submitted to the order of the Patent Office scrutiny, one at the time of the original grant, again at the time of the re-issue, and finally when the re-issue was extended. You have very strong assurance that nothing could be found against it, and that it is good and valid for all it purports to secure.

"The claim is to the combination of a conductory made of any suitable material, with a planing machine cylinder, in such manner that the shavings, dirt, etc., shall be thrown into the conductory, and thereby be conducted away from the machine, their travel through the conductory being aided by the current of air produced by the revolution of the cylinder.

"I have been familiar with all the principal planing machines in use for the last thirty years, and never knew or heard of such a combination prior to the date of your original patent. I have no hesitation in saying that my opinion is that the 13th claim referred to, is in all respects good and valid, and that you can enforce it against all infringers and recover of them damages for past infringements, and obtain injunctions restraining them from future infringements."

The next document is an opinion of Samuel A. Duncan, who says:

"The patent evidently assumes that you are the first one to utilize the air current caused by the revolution of the cylinder, for the purpose of conveying the shavings, chips, and dust away from the works into a conduit through which they can be taken to any desired destination, and thus be prevented from encumbering the machine. Upon this theory the claim of the patent (13th clause) admits of but one interpretation—it covers every form of conductory for the removal of shavings, the mouth of which is placed in such position relatively to the planing cylinder, that the current of air generated by the revolution of such cylinder will cause the shavings and other debris to enter such conductory.

"The specification describes the special form of the conductory shown in the drawings as being attached to the cross-head, but the claim is not thus limited, and evidently this special mode of mounting the conductory is a matter of convenience merely, and not necessity.

"Some question seems to have been made as to whether the air current caused by the revolution of the planing cylinder, is strong enough to force the shavings through the entire length of the conductory. This would depend entirely upon the length and inclination given to the conduit constituting such conductory. Of course a conduit might be made of such length, and so arranged, that the force of the air current would be weakened by friction against the interior walls to such an extent as to render it unable to carry the shavings entirely through; but even such a structure, in my opinion, would embody your invention, provided the air current be sufficiently strong to carry the shavings into the conduit. The main object will have been accomplished, namely, the shavings and dust will have been removed automatically from the bed of the machine, and by means of the planing cylinder acting as a fan blower to drive them into a conduit through which they can subsequently be conducted to any desired place of deposit."

In regard to the exhaust-fan and fan-blower, it is claimed that the Stover Machine Co. are the owners of the patents of Ransom Cook, granted November, 1861, and the opinion of Mr. George Gifford is brought forward, who says:

"I have carefully examined copies of the aforesaid patents in connection with the pre-existing state of the art in reference to the subject matter to which they appertain, and my opinion is that Cook does cover the combination of a fan with the tube or pipe, so as to avail of the joint power of the fan suction and the blast produced by the centrifugal force of the cylinder."

Finally, the Stover Machine Company say, in regard to what they call their conductory clause: "It has been examined into by a large number of planing mill proprietors, and, after a thorough investigation, have not only procured a license for its use, but have given certificates to this effect."

Now let us look at the other side of the question. In

regard to the patents of Cook, Nos. 33,693 and 33,694, dated November 12, 1861, it is found that, in view of several patents of prior date, showing the combination of an exhaust-fan and fan-blower with a conductory for the same purpose, his patents are limited in their scope to mere details of construction confined to the form and arrangement of the fan vanes; and regarding the 13th clause of the claim of the Stover patent, the following extracts from the patent of N. G. Norcross, dated February 12, 1850, No. 7,087, for wood-planing machines, are sufficient to satisfy any one, and to prove in any court of justice, the utter worthlessness of this claim, and also to show how an innocent inventor may be misled by a repeated oversight of the Patent Office, and the blind assurances of eminent counsel:

"The rotary cylinder is arranged within the upper part of a conductor in such a manner that the shavings or wood removed by it from the board, shall pass or be thrown into the said conductor. This conductor should be made so close that no shavings or chips can escape from out its sides while the machine is in operation, the object of it being to collect the shavings or chips and preserve them from accidental contact with fire. This conductor may lead down and open into a close box or chamber formed under it, or under the planing machine. The said conductor and its chamber, or either of them, may be made in any suitable manner, and there may be applied to either one or both of them one or more suitable openings for the purpose of removing the accumulated shavings. As the rapid revolution of the rotary cylinder causes it to operate on the air somewhat like a fan-blower, there will be a current or currents of air, more or less rapid, created in the shaving conductor or chamber. In order that such currents may be rendered advantageous, a pipe may be led from either the conductor or the chamber, and be carried therefrom out of the building, or into such an apartment or place as circumstances may require. The currents of air which are caused to rush into the conductor, prevent the escape of any dust or shavings, and force the same downward."

In the adjoined illustrations Fig. 1 represents Norcross's planing machine; A is the frame, B B the rest-bars, C the board to be planed, and E the rotary cutter-head revolving under the same, and planing the board from below; m^2 is a conductory connecting with a chamber or receptacle n^2, and a^2 is a pipe leading from this receptacle to give exit to the air. In the specification it is especially mentioned that the pipe a^2 may be connected immediately with the conductory m^2, omitting the chamber n^2. It is evident that when this is done, the identical arrangement claimed by Mr. Stover is obtained.

In regard to Mr. Gifford's opinion upon the Cook patents, it is evident that neither of said patents show or describe his apparatus applied in connection with the rotary cylinder of a planing machine. These patents *do not* cover the combination of an exhaust fan and conductory with the cylinder of a planing machine so as to secure "the joint power of the fan suction and the blast produced by the centrifugal force of the cylinder."

If the association of Mr. Stover's patent with Cook's will produce the desired combination, a similar connection may be effected between the patent of Norcross cited and the patent of T. Fairbanks, for example, dated May 26, 1843, No. 3,105, wherein an exhaust-fan and conductory are clearly set forth, and still antedate Mr. Stover's patents.

This machine is represented in Fig. 2 in perspective, and in Fig. 3 in section. The same letters refer to the same parts; A is the grinding wheel, *a* the conductory, C the chamber to receive the material ground off, E an exhaust fan, and F a continuation or extension of the conductory.

With the plain facts of the case again placed before them, every wood-worker should be satisfied that Stover's demands have no foundation of right, based as they are upon the most absurd claims. We shall take every occasion to assist the wood-working interest in exposing the falsity of his pretenses, and advise a determined resistance to his demands at each and every point.

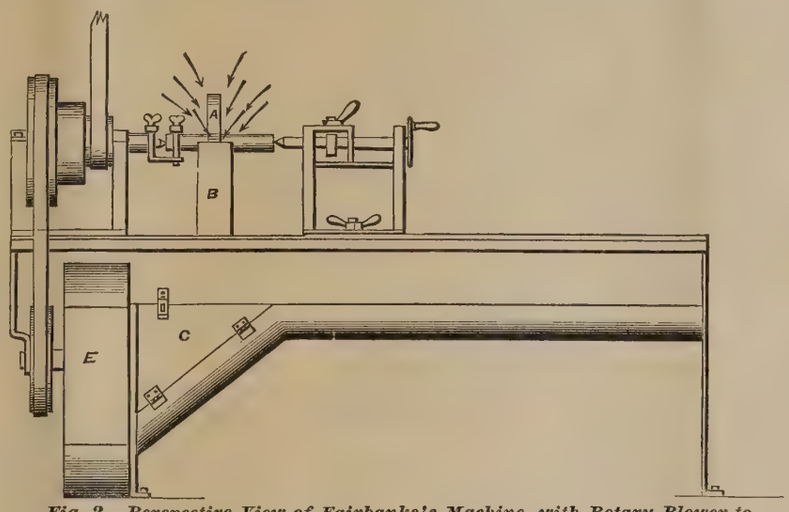


Fig. 2.—Perspective View of Fairbanks's Machine, with Rotary Blower to Remove the Dust, Patented May 26, 1843.

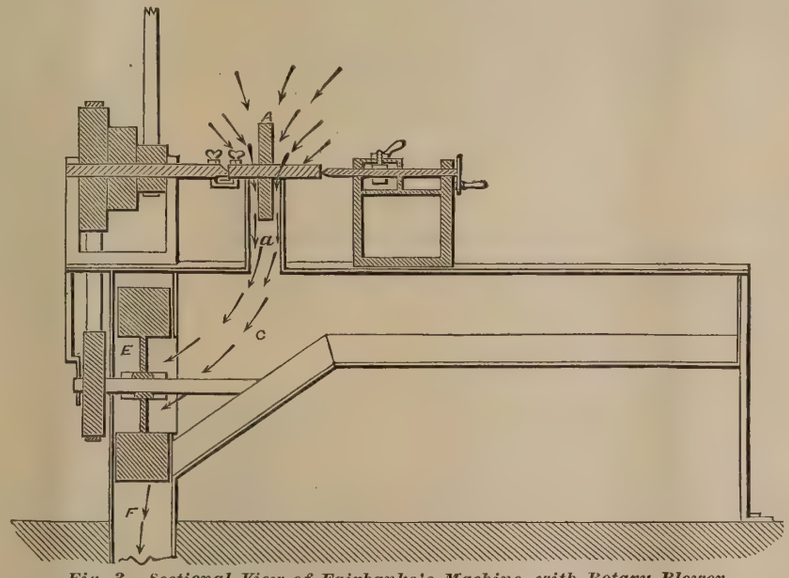


Fig. 3.—Sectional View of Fairbanks's Machine, with Rotary Blower.

Rock Drilling by Electricity.

In a recently published work of M. Gaston Planté—"Récherches sur l'Electricité"—the author mentions a new application of electricity which had not hitherto been published by him, and which is of considerable interest.

After describing the process of engraving on glass by electricity, that he made known in 1877, he goes on to say: "We have seen that one of the electrodes conducting an electrical current of a certain tension being brought in contact with glass, in the presence of a saline solution, it acts like a graver or diamond by tracing grooves in the surface of the glass, and even digs into it quite deeply. In spite of its great hardness, rock crystal can also be attacked by the same method; and, if not engraved regularly, it at least cracks into small fragments, and is finally disintegrated."

In view of this, M. Planté suggests that the electric current, under conditions analogous to the above described, might be substituted for diamonds in the operation of drilling rocks. He states that electrodes of platinum would not be necessary, for here it is not the metal of the electrode that is affected, but the silicious matter in contact with a saline solution. Metallic points or projections suitably located at the extremity of the drill, isolated on a part of its length, and actuated by a rotary movement, would lead the electric current to the surface of the rock to be pulverized, and would thus replace those numerous and expensive diamonds which are set in the heads of the drills employed in the present system of rock boring.

Utilizing Iron and Steel Shearings.

Thin shearings, or pieces of iron or steel—such, for example, as the scrap from cutting iron sheets for tin-plate making, and from various other operations in which thin sheet iron or steel is employed—are very frequently re-worked with other metal, either in the puddling furnace or in the refining furnace. In some cases the scrap is placed loose in the puddling or refining furnace, but more commonly it is made into bundles. In any case the binding only serves to keep the material together while heating up, for the bundle then falls apart, allowing the metal to mix with the remainder of the charge upon the bed or hearth of the furnace. There is much loss in this process of re-working, 30 cwt. of this scrap not producing more than a ton of manufactured metal. According to the invention of Mr. J. H. Rogers, of Llanelly, England, the shearings or waste pieces of thin iron or steel are compacted together into masses or blocks, and these are placed in a re-heating furnace, and, when heated to a proper temperature, are consolidated under a steam hammer, or in any other convenient way. In this manner he can obtain a ton of manufactured metal from 23 cwt. of shearings. In order to form the shearings or pieces of iron or steel into masses or blocks ready for heating, he places them in a box or mold, and with a steam press or other suitable machine he presses the contents of the box or mold until a compact block is obtained. The mass thus compacted is withdrawn from the box by an opening provided for for the purpose, and which is closed by a door while the material is being molded. The compacting of the scraps is performed in a cylinder or mold, wherein they can be compressed by a kind of steam hammer. To discharge the molded mass, the box is opened, and by means of a bar inserted at a suitable hole it is forced out in a condition to go into the re-heating furnace. In the furnace, and in the subsequent hammering, the blocks or masses are treated in the same way as piles or blooms.

Economy of Coöperation.—In his report as Commissioner to the Paris Exhibition, ex-Governor Howard, of Rhode Island, speaks of Switzerland as the cheapest cloth-making country in the world. This is due, he

says, to the fact that Swiss factories are run largely on the coöperative plan. Mills are family concerns, and owners and operatives live and work together. The hands themselves are very often property owners and have a general interest in the prosperity of the community. As the result, there is a more general spirit of contentment among the Swiss factory workers than anywhere else in the world. Wages are very low.

Building Intelligence.

NEW YORK CITY BUILDING ITEMS.

On Fifth avenue, between Fifty-first and Fifty-second streets, over a hundred laborers are at work excavating for the foundations of W. H. Vanderbilt's mansion. It is said that no home in New York will compare with this great structure after its completion. It is not yet decided what style of edifice shall cover the ground. Mr. John B. Snook is the architect. The contract calls for an excavation of 8 or 10 feet only, and the mason argues from this that there will be no cellar but merely an English basement. There are to be two houses, and with their grounds they will occupy exactly half the square. Mr. Vanderbilt's house is to be on the Fifty-first street corner, and will include a space of 85 by 125 feet. The other building will be a double house, the two dwellings being intended for Mr. Vanderbilt's daughters, Mrs. William D. Sloan and Mrs. Elliott F. Shepard. The structure that is to be the dwelling of the two daughters will have as large a frontage as Mr. Vanderbilt's, but will be 10 feet shorter. It will be near the Fifty-second street corner, and there will be a space between it and Mr. Vanderbilt's house, and a wider space in front and behind, north and south of both edifices. Mr. Vanderbilt is putting up a large stable a block away from his new house, at Madison avenue and Fifty-second street. Three houses have been torn down to make room for it. It will be 75 feet wide by 100 feet deep, and will contain a ring for exercising the fast horses on days in which Mr. Vanderbilt does not exercise them himself.

Immediately above the scene of operations for Mr. Vanderbilt's house and the dwellings for his daughters, more workmen are employed at excavating. This is on the northwest corner of Fifty-second street, where Mr. W. K. Vanderbilt, a son of Wm. H. Vanderbilt, will build a large and costly mansion. Mr. Hunt is the architect, and has made many plans, but Mr. Vanderbilt has not yet decided upon any one. The excavation ordered is 100 feet wide on the avenue and 125 feet deep, but this includes a wide area in front and on the sides, and wide vaults in the rear.

Still further up the avenue Mr. Cornelius Vanderbilt has bought Mr. John Bigelow's house on the northwest corner of Fifty-seventh street and Fifth avenue, and Mr. Louis Lorillard's house adjoining on the avenue. Workmen are now pulling these buildings down. Mr. Post is the architect of the house to be built on this corner. A few minor changes are to be made in his designs before it is completed. Those who have seen the design say it will be the handsomest house on the avenue if the other Vanderbilts do not build still finer structures. The lot measures 45 by 100 feet.

An association has just been formed, with a capital stock of $200,000, to replace the present Fulton Market by a building two stories in hight, in the center of which is to be a rotunda, covered by an iron and glass roof, to give light and air to the interior stands. It is proposed to divide the second floor into offices, dressing-rooms, meeting-rooms, and stands for small dealers. The butchers' stalls, and those for provision dealers and large fish dealers, will be on the ground floor. The cost will probably exceed $250,000.

A six-story brick store, designed in the Victorian Gothic style, is now being built from designs prepared by Edward H. Kendall, at the corner of Fifth avenue and Fourteenth street, formerly occupied by Delmonico. It measures 42 by 130 feet. The estimated cost is $60,000. John T. Conover is the contractor. It is to be completed about the first of September.

A first-class iron-front store, five stories high, and 50 by 119 feet, is building at 113–117 Fulton street, for A. C. Downing, to cost $50,000. W. H. Smith is the architect, and A. G. Boyer & Brother the builders.

C. Warner, architect, is building on Fulton street a six-story store, 49 by 50 feet, for McKesson & Robbins, to cost $25,000. Burns & McCann are the builders. The same parties are building on Ann street a six-story store, 51 by 60 feet, to cost $30,000.

G. W. DaCunha is the architect of the store now building for Henry Welsh on Franklin street. It will be three stories high, will measure 84 by 84 feet, and will cost $40,000.

H. M. Congdon, architect, is to build at 153 Mercer street, a first-class store, 25 by 85 feet, for A. & E. Strang, to cost $15,000. Dolsen & Arnott are the builders.

A five-story iron-front store is to be built at 121 Mercer street, for the New York Eye and Ear Infirmary, from the designs of D. & J. Jardine, to cost $20,000.

At the corner of Broome and Mercer streets, S. A. Warner, architect, is building for E. C. Cowden an iron-front store, 25 by 100 feet, to cost $35,000.

At 484 Broadway a five-story iron-front store, 25 by 70 feet, is building for J. J. Astor, to cost $25,000. J. Webb & Son are the builders.

On East Twentieth street, D. & J. Jardine, architects, are building for Roosevelt & Carter an iron-front store, five stories high, to cost $30,000.

On Bond street, S. D. Hatch, architect, is building for Robbins & Appleton a six-story iron-front building, which will cost $120,000.

W. H. Smith is to build on Fulton street, near the old North Dutch Church, a large building, which will cost $50,000.

The members of the Produce Exchange have decided to erect an Exchange building at a cost not exceeding $650,000.

Chicago, Ill.

Leopold T. Kadish is to build a natatorium on West Madison street. It will cost about $20,000.

S. L. Crozier, of Philadelphia, is to build a five-story store, 16 by 80 feet, on Wabash avenue. It will cost about $50,000.

J. Rothschild will build a double stone-front dwelling, to cost $12,000, on Wabash avenue, south of Twenty-sixth street.

The members of the Sixth Presbyterian Society are to build a brick church with a seating capacity of 800, the cost being limited to $15,000.

Christian Wahl has the plans drawn for a block of seven houses, to be built on Michigan avenue, between Twenty-fifth and Twenty-sixth streets.

On West Taylor street the chapel of the Sacred Heart, 40 by 120 feet, will be built of pressed brick, with limestone finish, to cost $25,000 Egan & Hill are the architects.

A large block on the corner of Monroe and Dearborn streets has just been completed for Orilly & Blair, at a cost of $65,000. It is built of pressed brick, with limestone finish. It covers an area of 104 by 120 feet. The main or first floor is divided into two stores, one with 40 feet front by 120 deep, and the other 64 by 120; the second floor is fitted up for offices, and the remaining floors will be occupied by a printing establishment. The design is Gothic. Geo. H. Edbrooke, architect.

White lead works for Hugh McBirney & Co. are to be built on the corner of Sixteenth and Brown streets. The improvement covers a space of 200 by 165 feet; main factory building, three stories and basement, 50 by 100 feet; boiler house, 38 by 40 feet; corroding house, 65 by 204 feet; office, one story high, 18 by 36 feet; barn, 20 by 24 feet; chimney stack, 80 feet; inclosing wall 20 feet high around the entire premises. Treat & Foltz are the architects.

McGraw & Downey have been awarded the contract for the masonry work for W. F. Storey's new residence at the corner of Forty-third street and Grand Boulevard. The minor contracts have not as yet been let, as it will be two years before the mason work will be finished. The entire cost of the house will be about $300,000. The exterior is to be of Vermont marble, while white marble will be used for the bath-tubs, stairs, and interior fountains. The extreme dimensions are 128 by 150 feet. O. H. Placey is the architect.

Egan & Hill are the architects for the St. John's Roman Catholic church now building on the corner of Clark and Eighteenth streets, to cost $120,000. It is built of Lemont limestone, with bush-hammered limestone finish, and polished gray granite around the porches and windows. Hight of spire, 230 feet above the sidewalk; hight of main gable, 104 feet. The main building is 82 by 170 feet, with side transepts 40 by 100 feet. The style is modern French Gothic. P. Fanning is the builder; A. Mahon and John Garvey are the contractors. Rev. John Waldron is the pastor.

Detailed statement of new buildings for which permits have been issued during the Month of May, 1879, compared with the same month in 1878. May, 1879—number of buildings, 127; number of feet street frontage, 4,270; brick, 92; stone, 35; stores, 7; stores and dwellings, 20; dwellings, 71; manufactories, 4; public and office, 1; barns and stables, 19; miscellaneous, 5; basements and additions, 59; sheds, etc., 211; cost, $941,500. May, 1878—number of buildings, 97; number of feet street frontage, 2,991; brick, 52; stone, 45; stores, 8; stores and dwellings, 16; dwellings, 51; manufactories, 2; public and office, 3; barns and stables, 14; miscellaneous, 3; basements and additions, 41; sheds, etc., 158; cost, $635,500.

Miscellaneous.

The walls of the building for the Phototype Company at Holyoke, Mass., are rising rapidly, a force of about twenty men being at work.

Thomas M'Intosh was awarded the contract for the foundation and stone-work of the new university building at Greencastle, Ind., and work will begin at once.

A new brick and stone building for the Union School is to be built this season at Honeoye, N. Y., from plans prepared by J. R. Thomas, architect, Rochester, N. Y.

J. Hodgson, architect, is building at Indianapolis, Ind., a four-story brick and stone store, designed in the style of the French Renaissance, which will cost about $200,000. It measures 209 by 207 feet, and the upper stories will be finished off for a hotel.

At Toledo, O., Saengerfest Hall, 188 by 188 feet, auditorium seating 5,200 people, is to be built. The building is to be 92 feet to the peak of the roof; it will contain a dining-room, 100 by 38 feet, also kitchen, offices, etc. It will be in the Continental Gothic style, and cost about $10,000. Mayor Jacob Romeis is chairman of the building committee.

At Cleveland, O., a new armory is to be built, for the use of the Fifteenth Regiment Infantry, and the First Light Artillery, O. N. G. It is to be built on the lot just west of the police station, and will extend through from Champlain to Long street, 160 feet. It is to be about 80 feet wide and three stories in hight. The first story, opening on Champlain street, is to be devoted to a drill-room for the artillery, and, to facilitate movements with the guns, the floor is to be all clear. This will be accomplished by the introduction of heavy trusses, 13½ feet in hight and 17½ feet apart, which will carry the upper floors. The infantry drill-room floor is to rest upon the top, and the floor of the company rooms upon the bottom chord of the trusses. These trusses necessarily will be made very heavy, in order to carry the weight of the two floors and to withstand the effects of the tramping above; they are to be of wood and iron, built upon the Pratt system, in order to afford a passage-way through the middle of the trusses in reaching the different company rooms which are to be distributed among them, these trusses forming the partitions. The infantry drill-room, which will have a clear floor of about 80 by 155 feet, will be roofed over with the aid of bow-string trusses, the upper chord of wood and iron, on the Howe pattern, and the lower chord of iron rods. The walls will be of brick and stone, with stone block piers beneath the trusses. The cost of enclosing the building will be about $20,000. Work will be commenced immediately. Coburn & Barnum are the architects.

The Ingersoll Rock Drill.

There is perhaps no manufacturing company that can look back with more pride and satisfaction upon their record of industrial achievements than the Ingersoll Rock Drill Co. Every year since 1871 they have had one, two, or three medals awarded them by the managers of the various exhibitions held in New York, Brooklyn, and Philadelphia in the United States; London, Leeds, Manchester, and Cornwall in England; and Paris in France. Among the comparative tests the most remarkable was that in Cornwall, England, where the Ingersoll drill worked in competition with the diamond drill, when the former bored the same depth of hole in half the time it could be accomplished by the diamond drill.

There are, of course, other considerations which should enter into the estimate of the value of a rock drilling machine; they are durability, light weight, and consequent portability. No other machine made previous to the introduction of the Ingersoll rock drill could claim any of these essential properties. They were so defective and repairs were of such a serious and ruinous expense that no one would take the risk of steam drilling, and hand labor was persisted in; then the machines were so ponderous and massive as to be very unwieldy and laborious to handle and move about. In addition, the frame-work supporting the working parts was so clumsy that it was impossible to introduce the machine into narrow and uneven rock excavations, places where drilling machines are most needed.

All these objections were overcome by giving the machine here represented the following qualities: 1st. Durability, so that expense could be saved, both as to repairs and loss of time resulting from breakage. 2d. Simplicity, so that any ordinary workman could operate the machine efficiently. 3d. Light weight, so that two persons could easily handle and carry the drill, which is extremely essential in mines. 4th. Adjustability, so that the machine could be readily placed in position for boring holes at any angle.

In regard to the power applied, in open outside work steam is used, but under ground, where foul air exists and the presence of steam would increase the temperature and fill the surroundings with a stifling vapor, compressed air becomes a necessity. This compressed air serves the purpose of a motive power equally as well as steam; and more than that, it not only drives the drill, but cools the atmosphere, thus giving the workmen substantial comfort and fresh air. The compressor is located near the mouth of the shaft or tunnel, and pipes are laid to within a reasonable distance of the drilling work. These pipes are sufficiently large to allow free transmission of the air, thus avoiding friction, resulting from too small diameter of pipe. If the mine or tunnel is of long distance, it is often advisable to place a reservoir widway between the compressor and the drills; this serves to store up the compressed air in reserve for shorter conveyance from thence to the drilling work. It should always be borne in mind that the pipes must be much larger than the requisite discharge at the drills, for if it were otherwise there would be great friction resulting from the pressure of air constantly rushing through to furnish a sufficient quantity to drive the machines; for example, if a shaft were 1,200 feet in depth, it would be preferable to place the reservoir at a depth of say 900 feet, and between that point and the drills small pipe and flexible hose would be used; thus between the compressor and reservoir it would be advisable to use pipe quite large, for in doing so there would be an absence of friction, the pipes being larger they would always be stored full, and in a measure act as a reservoir for the entire distance.

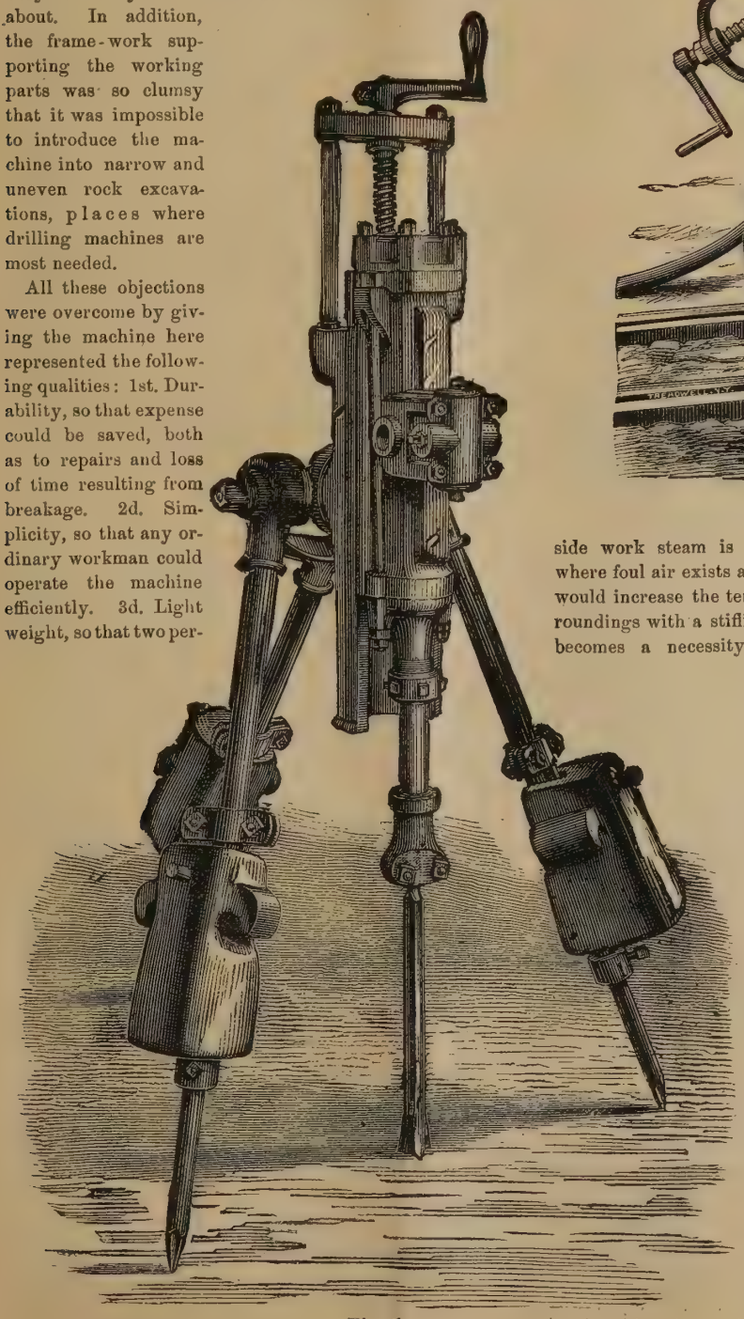


Fig. 1.

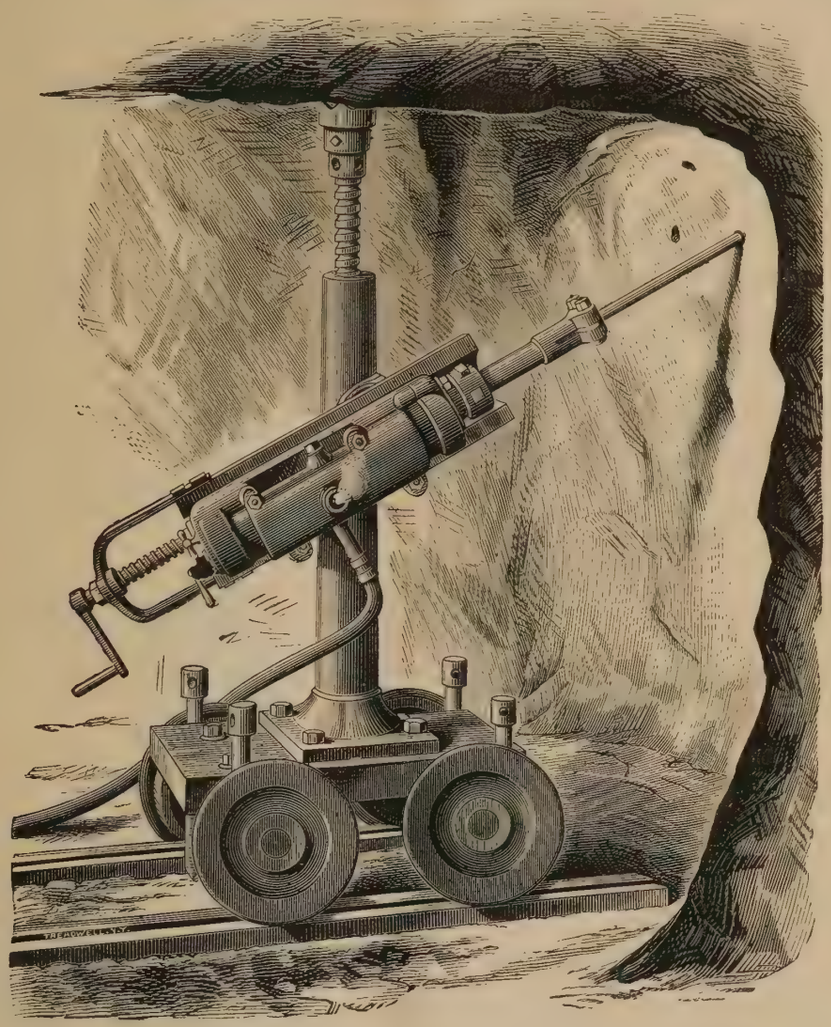


Fig. 2.

The compressor must be placed adjoining the steam or water power employed to drive it, so that one person will be sufficient to attend properly to both. If water power is used to work the compressor, the water wheel is applied by attaching to the shaft of the wheel a belt or gearing, and connecting with the compressor. Steam compressors have a steam engine attached and are driven by steam direct; others have a driving pulley and are operated by a belt from a separate engine or water wheel. In using water power there is a saving of fuel, cost of steam boiler, and in the price of the compressor. With water there is only the cost and erection of wheel, while compressed air can be conveyed for miles if necessary.

Fig. 1 represents the drill supported on a tripod and working downward in the open air by steam; Fig. 2 represents the same drill, driven by compressed air, working forward in a horizontal tunnel, and supported on a railroad truck.

These drills are especially adapted for quarrying and mining, and are in use by many of the largest firms engaged in such work, among whom we may mention the

following: S. A. Hutchings, R. R. contractor, Denver, Col.; C. F. Dunbar, submarine work, Port Colborne, Canada; Weatherbees, Sherman & Co., iron mine, Port Henry, N. Y.; Bodwell Granite Co., Rockland, Me.; Maj. H. M. Roberts, U. S. government engineer, Milwaukee, Wis.; C. P. Dixon, Dix Island, Rockland, Me.; H. McLaughlin, Bangor, Me.; Diamond Hill Granite Co., Providence, R. I.; Dirigo Slate Co., Monson, Me.; Knoxville Marble Co., Knoxville, Tenn.; Louisville Cement Co., Louisville, Ky. One of the greatest works on which these drills are being employed is the Sutro tunnel; while they are also used in twenty-four mines of the Comstock lode.

The office of the Ingersoll Rock Drill Co. is at 1½ Park Place, New York.

Underground Telegraph Wires.

Mr. Wm. Radde, the owner of the patent for the admirable invention of glass-lined iron water pipes, has applied the same principle to underground telegraph wires. For this purpose each iron tube is filled with from 10 to 20 glass tubes, as long and of as small a diameter as practicable, and the spaces between the glass tubes are filled with an isolating cement. Through these interior glass tubes metallic conducting wires are passed, and length after length attached to one another, with appropriate connecting boxes.

This is only one of the many devices invented for this purpose. We will here describe another now practically applied in Chicago, which the local papers call "greased lightning." It is the invention of Mr. D. Brooks, of Philadelphia, who several years ago invented what is known as the "Brooks insulator."

A small copper wire is wound with cotton to secure insulation. Several of these insulated wires are bound into one cable, which is then wound with a heavy coating of cotton. The cable is then drawn into a pipe, to be afterwards completely filled with oil, which, especially at a low temperature, is a good non-conductor. When the pipes have been laid, perpendicular tubes will be connected with them, for the purpose of keeping them full. In crossing rivers it is proposed to have the pipes made to fit the bottom of the streams. It is not intended to put the wires in the country underground, but only those inside the limits of large towns. One difficulty in the way of the perfect working of the plan at present is that the insulating quality of the oil decreases very rapidly as its temperature rises, and during hot weather this may cause some trouble; but a more perfect insulating fluid may be found which will remedy this fault. Another is that whenever lightning strikes the cable it carbonizes the oil at the point of greatest conductivity, or of the least resistance, and makes a little string of carbon to the pipe, which furnishes an excellent "escape." This can be remedied, however, by having the pipe made in sections, so that when such an escape is formed in any one section, the oil can be taken out, and in, and out, until the thread is broken, when the section will be as good as before.

Enormous Power Required for Electric Light.

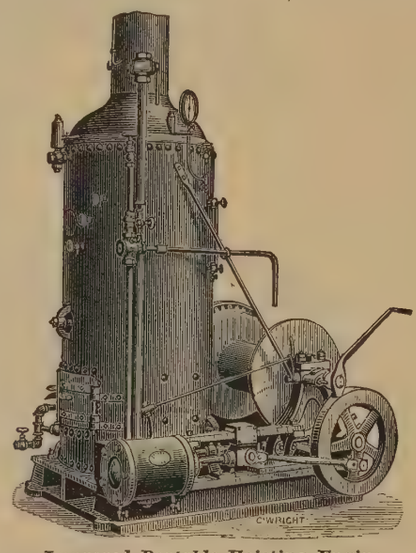
Notwithstanding all the claims about the economy of electric illumination, it appears that it is by no means cheap after all, but, on the contrary, highly expensive. It has often struck us that the power driving the magneto-electric machines used for evolving this light was much greater than represented; one had only to make an estimate by the combined consideration of the dimensions of the belt used and its velocity, also of the furnace used to furnish the steam. Last winter, in order to furnish two electric lights outside the Roman Catholic Cathedral in this city, quite a large fire was required under a good sized boiler, consuming an amount of coal, which, if converted into gas, would have been sufficient to feed gas jets by the hundred. The same has been observed in Paris; the furnishing of light for 1,000 feet length of streets required an engine of 20 horse-power, so that in order to furnish electric light for the 550,000 feet of streets in Paris, it would require a motive force of more than 100,000 horses, which is more than double the power employed in all the industries in Paris and the departments for 100 miles around, taken together.

Statistics show that for every 1,000 cubic feet of gas consumed in the streets of Paris, 9,000 cubic feet are burned in private houses, churches, hotels, operas, gardens, and places of amusement; so that in order to furnish light for all would require a force of 1,000,000 horses; taking the average consumption of coal to be 3 lbs. per hour for every horse-power, it would require 3,000,000 pounds, or 1,500 tons of coal per hour to furnish the power required to develop illumination by electricity. After such exposés holders of gas stock may feel easier.

Improved Portable Hoisting Engine.

The extensive use of and continual demand for small hoisting machines in a city like New York, where the most extensive commerce necessitates the incessant handling of goods, has naturally resulted in improved appliances of this kind, stimulated by a wholesome competition.

The most available of these hoisting machines are those which combine boiler, engine and hoisting gear on one single base, and if so contrived as to occupy as



Improved Portable Hoisting Engine.

little space as possible, and to be adapted for transportation, they are of course the most available. One of the best machines of this class is represented in the adjoined engraving; it is manufactured by the Lidgerwood Manufacturing Company, of 96 Liberty street, New York. Nothing especially new is claimed for it; except that the general design is new, and the main object being to leave out all material at those points where it would not add to the necessary strength, and to use it abundantly where most needed. Thus the square frame on which the boiler, engine and hoisting gear stand is a heavy casting in one piece, which not only gives stability to the whole, but bears easily all the strain between steam cylinder, crank and gearing. As the engraving shows, the cylinder is horizontal, placed on one side of the boiler, while on the other side is the feed pump, with composition valves and air chamber, being driven by an eccentric from the crank shaft, which also carries a band fly wheel.

The twenty years' experience which the manufacturers have obtained in this particular line has not been in vain, and the result is that the hoisting engine which they produce at the present day, and here described, is simple, compact, durable, effective and economical. It is also extremely easy to handle, requiring only very ordinary skill to take care of, a special merit being that it is very quick in obeying the hand that guides it. This of course is due to good workmanship applied to the best material and the proper proportioning of all the parts. The piston rods, valve stems, pins, etc., being all made of steel, and the wearing surface extra large, by which the pressure, and consequent friction, is greatly reduced, producing a better, stronger and livelier engine than the old style, while as a whole, notwithstanding the greater strength, the engine is much lighter, more easily transported and moved about than any other of the same power.

Another improvement is the friction drums; these are quite simple and so constructed as to out-wear any old-style clutch engine, the friction being composed of hard hickory wood, endwise of the grain to the labor, with large allowance for wear and tear. The design of the slides, cross heads, connecting rods, etc., is of the locomotive style, with proper provision throughout for taking up all lost motion. The gearing being cast from cut wheel patterns, runs true and smooth. The boilers are throughout well made, properly braced, stayed, and of large capacity in proportion to the capacity of the engine, each one of them being inspected and insured by the Hartford Steam Boiler Inspection and Insurance Company. The fixtures are complete and of the best quality, each engine and boiler being fitted with gauge cocks, water gauge, safety valve, steam gauge check, stop and blow valves, three-way exhaust, work and fire tools, water-tight ash pan, smoke stack with cover, grates, etc. Each engine is fitted with a gipsey or winch head, and will be mounted upon wheels if desired, all being set up and tried with steam before leaving the works.

We advise all who intend to invest in a hoisting machine to address, or better still, visit the office and salesrooms of the company at the address given above.

The Strikes in England.

We reprint the following article, which we find in the London *Daily Telegraph*, as it is worthy the consideration of American manufacturers and workmen, for two reasons; first, for the sensible view it takes of the nature and ultimate results of strikes, and second, the information it gives in regard to the competition to which English manufacturers are exposed by other nations, especially the United States. The article is as follows:

"With their strikes, their shortened hours of labor, their diminished pride in their labor, their over-developed trade unionism, and their want of education to see beyond immediate to future profits, workmen are ruining the commercial eminence of this realm and killing their own prosperity.

"These are sharp and serious words, but they are true; and if those whom we address will not take them to heart, we shall see no lasting return of good times, but mere fitful recoveries, ending more and more in the completed triumph of the foreigner. There is no branch of industry in which he does not at present struggle to supplant the British workman. We take up a trade journal, and, opening it at hazard, we find that American and German pencil-cases are competing successfully with local goods in Birmingham; that Japan is sending excellent and cheap boots made of American leather; that the high-class glass trade is rapidly going to France; that steel rails from Philadelphia are under selling those of the north; that in paper, carpentering, locksmithery, and even cloth and calico markets, English-made articles are being thrust every day aside by Belgian, Norwegian and American commodities. Look where we will, the industrial products of the foreigner threaten our own more and more keenly every year, not merely by qualities of taste, skill and material, but by that cheapness of manufacture which comes from longer hours, lower wages and greater frugality and temperance. Side by side with these alarming manifestations, what do we behold in the centers of British industry? Everywhere strikes, strikes, strikes; linen hands at Forfar, carpenters at Dover, shipbuilders at Jarrow-on-Tyne, stonemasons at Ashton, sailors in the Potteries, joiners at Durham, mill-hands at Blackburn, dock porters at Liverpool; but all with what consequence? Invariably, and whether the men win or lose their fight, with the consequence of driving fresh nails into the coffin of British supremacy in trade.

"Are the leaders of the workingmen thoughtless enough to tell them that where they wring an extra penny from employers, or knock off an hour or two from their week's score, they have gained anything? The contrary is unhappily the case. At such a time as this, when all the world of commerce lies under a cloud, these insensate strikes have but one effect—to let in the foreigner. If matters proceed as at present, two millions of working people will have to leave this country, and thrifty Frenchmen, Belgians and Yankees will find good cause to laugh at the English dolts who held command of the world's trade, and lost it for the sake of an extra hour or two of play and another quart of beer per diem."

Plastering and Plasterers' Tools.

The principal material used by plasterers is burned and ground gypsum, commonly called plaster of Paris, after the place from which it was at first obtained. However, it is now obtained in many localities, and fortunately is very abundant, therefore comparatively cheap.

Burned limestone is another ingredient, which, in the form of slacked lime, is mixed with plaster to retard its setting too rapidly. It needs no grinding, as the act of slacking it with water causes it to swell to more than twice its original bulk, and fall to powder. The water molecules penetrate between the lime molecules, causing a perfect separation, every lime molecule combining with a water molecule, as there is a very strong chemical affinity between them, which affinity manifests itself by the great heat developed when slacking lime—a fact well known. Those kinds of limes which swell up most by slacking are called rich or fat limes, and can stand more sand. Poor limes are those which do not increase much in bulk, and cannot stand as much sand as the others. None of these limes set under water.

Hydraulic limes, or cements, do not fall to powder when slacked, but must be ground like plaster after being burned. There are various kinds, some of which set under water in twenty days, others in a week, and the best kind in three days. The latter is very hard in one month, while the other slowly setting hydraulic limes seldom become very hard.

In regard to the cause of these differences, it is simply the chemical composition of the stones from which the plaster, lime, or cement is made. Gypsum, or alabaster, which, by burning, produces plaster of Paris, is hydrated sulphate of lime—chemical formula, CaO, SO_3, $2H_2O$; the burning drives out the water ($2H_2O$), and this is again absorbed when the plaster sets. Pure limestone, or marble, which by burning gives a fat lime, is hydrated carbonate of lime—formula, CaO, CO_2, $2H_2O$; the burning not only drives out the water, but also the carbonic acid (CO_2), leaving nothing but oxid of calcium (CaO), or quicklime. When mixed with sand it sets in the air, the sand, which is, chemically speaking, silicic acid, combines gradually with the lime and forms a silicate, which is very hard; but this takes a long time, hence old mason work is always hard, and fresh mason work very soft.

When limestone contains only from 1 to 6 per cent of impurities, the lime is fat, but when the impurities are from 15 to 30 per cent it yields poor lime. These impurities are sand, magnesia, iron oxid, etc.

If, in addition to the above impurities, alumina is also present in sufficient quantity, the lime is hydraulic; 10 per cent gives a moderately hydraulic lime, 18 per cent is better, and 30 per cent of alumina and silica, with some oxid of iron, gives a very good hydraulic lime.

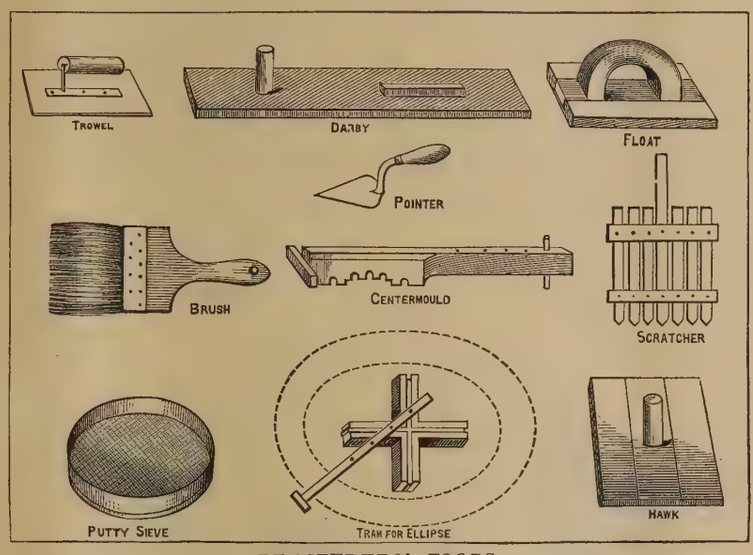
In regard to the tools used by plasterers, we represent on this page a set, taken from Cameron's "Plasterer's Manual," a most excellent work on this subject, published by Bicknell & Comstock, 27 Warren street, New York.

The first tool is the *Trowel*, very different in shape from the brick-layer's trowel. Its best size is 4 by 12 inches, made of steel, light and smooth, with a round handle.

The Hawk, seen at the extreme right lower corner, is made of hard pine; the best size is 13 or 14 inches square, 1 inch thick in the middle and thinner at the edges—say ¼ inch. A cleat is dovetailed on the back, to prevent warping, while a handle 5 inches in length completes the tool. It is held in the left hand and used for holding an amount of plaster, which is taken off by the trowel, carried in the right hand, and applied to the wall.

The Darby, size 4 feet by 4 inches, is made of hard pine. One handle is like that of the hawk, while the other is a narrow strip, as shown in the figure. Some plasterers make this strip 6 or 8 inches long, while others make it as long as the whole board. This tool is used to flatten and straighten the plaster applied by the trowel.

The Float is also of hard pine, size 4 by 10 inches.



PLASTERERS' TOOLS.

It is used to rub down uneven parts, and as it wears out soon on its surface, the same handle and cleat are used for several face boards successively when the old ones are worn out.

The Scratcher is made of pointed slats, set 1 inch apart, and kept in position by cross pieces; one slat is left longer than the others, and answers the purpose of a handle.

The Pointer is like a brick trowel, but smaller; it is used where the trowel cannot reach the parts, and is also very handy for cleaning the other tools.

The Brush, about 7 inches wide, made of good bristles, is used to wet the plaster while rubbing and smoothing it down.

Center-Molds.—These are in various shapes, according to the moldings desired. Our figure represents one intended to turn on a center for making circular moldings, such as are used around rosettes, principally in ceilings; for straight moldings the arm carrying the pivot is omitted.

Tram for Ellipse.—When oval moldings are required two pins are placed in two holes of the handle to the center-mold, and made to move in the rectangular grooves of the cross represented in the lower central figure, which illustrates one of the practical ways to describe an ellipse, and the best way in which a plasterer can make an oval molding.

The Putty Sieve, represented at the left of the preceding figure, is used for straining the plaster when used for the finishing coat, so as to be sure not to have any lumps, which would spoil the smoothness of the work. Any good sieve, however, may be used for this purpose.

Furniture Woods of the Future.

Black walnut for furniture uses is about the poorest hard wood that could have been selected. It became fashionable from no known cause, but simply from one of those strange freaks that attack human beings, and it has had a run unequalled by any other wood. The demand for it has developed many improvements in finishing and in cutting, so as to exhibit the grain to the best possible advantage, until now one may get a handsome suite of walnut, (we are speaking only of the wood), so far as the eye sees it. Had the same finish been adopted when the wood was first used for furniture, the demand for it might be explained—but its qualities were not then understood—and there is no denying that the way in which it is put on the market has the merit of attraction. But it is not a good wood for furniture; it is not lasting. The very nature of it prevents its ever standing the test of years. It will last for a decade or a generation, but who, in years to come, will be able to show a walnut bedstead that belonged to their grandfather? Some may smile as the question meets the eye, and ask, Who wants to have a bedstead a hundred years old? A feeling of reverence is growing, and in time the attachment to old things will be stronger, as it is in England; and old furniture will be one of the choice things to prize, much as old china is now by a large class of people.

As long as walnut is the popular wood, there is little likelihood of this idea being carried out. It is too soft and too porous to be enduring. It shrinks and swells, no matter how well cured; it will drink in moisture in damp weather, and then dry so quickly as to start the glue joints and loosen the dowels. Everybody knows how it will crack and creak as it expands and contracts, going off like a pistol-shot, waking one out of a sound sleep with the impression that the bedstead is falling to pieces.

Whether its bad qualities are being found out, or people, ever ready for a change, are getting tired of it, certain it is that a demand is growing for other kinds of woods. Ebony (or ebonized wood) struggled for recognition last winter, and had a partial success; but, except for small articles of fancy cabinetware and some styles of parlor furniture, ebony is too somber. Ash is gaining in favor, but experience has proved that this wood comes up periodically, has a run, and drops back again. If a change is to take place, and we know that a change always suits the masses, it is to be hoped that the various kinds of oaks are to be the woods of the future. These have the necessary qualities to make elegant and lasting furniture, and the time has arrived to put good designs in these woods upon the market.

Improved Enamel on Iron.—Messrs. Cribben, Sexton & Stoddard, of the Elastic Enamel Works, Chicago, have recently introduced an improvement in enamelled iron, which possesses many excellent features. It consists of a very thin, vitreous coating of a gray color, applied directly to the surface of the iron. Its adhesion is much closer than that of ordinary enamel, and it does not chip or star when struck sharply with a hammer or sharp instrument. The makers claim that this enamel is insoluble in water or any of the acids, except those which dissolve glass, and that it is entirely free from any dangerous ingredient whatever, so that it seems to secure the best results attainable for an enamel on iron. The above firm have a foundry in Chicago, in which they employ about sixty molders in the manufacture of this kind of hollow ironware; they have a capacity for double their present production, which they expect to need as soon as the goods are generally known to the trade.

Remarkable Boiler Explosions.

We are indebted to the Hartford Steam Boiler Inspection and Insurance Company for the engravings on this and the opposite page, representing the result of an explosion of boilers which they had inspected and insured, and paid as such insurance the sum of $9,500, being the amount of damage suffered.

Fig. 1 represents the plan of the buildings belonging to the Chesapeake Nail Works, in which the boilers in the rolling mill exploded, showing also the direction of their flight by arrows. They were plain cylinder boilers, 36 inches in diameter and 30 feet long, made of ¼-inch iron, supported upon iron columns and suspended over puddling furnaces in the usual manner. The heaters and puddlers performed their duty below, while the water feeder occupied a platform above. The flues of the boilers (marked 1 and 2) had been repaired, the brick-work being out of order, and had been out of use for several days. The boilers marked 1, 2, 7 and 8 exploded with terrific force, completely demolishing the wing of the rolling mill in which the boilers were located, and doing other serious damage, as will be explained further on. The explosion occurred in the interim of a change of "turns;" the night hands had all retired and only a few of the morning "set" had arrived. Had the explosion occurred fifteen minutes later the loss of life would have been appalling; as it was, the water feeder, who was on his platform attending to his duty, as is believed, was instantly killed, and several others were seriously and two fatally injured.

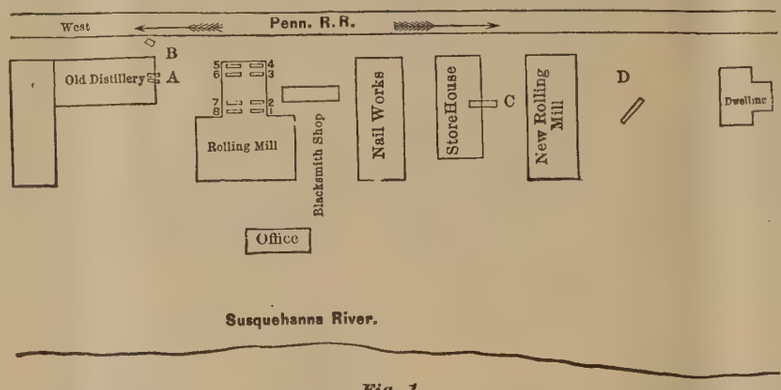


Fig. 1.

Many theories have been advanced regarding the cause of the explosion, as is usually the case, especially as from a careful examination of the fragments of the boilers no indications of special weakness could be found. The iron was thinned slightly on the bottom of the boilers, but not sufficiently to cause any apprehension on account of the pressure used. The boilers were not over-worked and were not strained; they were examined externally and internally twice each year. The portion of boiler marked C, near the storehouse, had somewhat the appearance of burned iron from an external examination. The color of the iron indicated that the water had been low, if not entirely out. Tests made by breaking the iron showed, however, a good degree of strength, and the fracture, while being a little brittle and dull, did not indicate so great a deterioration as one would infer from a surface examination. The brick setting of boilers 1 and 2 had just been overhauled; during this time they were of course cold and out of use. On the morning of the explosion the puddling furnaces were started up, and steam was being raised. It was the custom when the boilers were blown down for repairs to move the weight on the safety-valve lever in, and when the boilers were again put under steam to move the weight out to the point of maximum pressure. All these eight boilers were connected with one main steam pipe. Just what the water feeder did while on the platform will never be known; if he had neglected to fill the boilers with water when the furnaces were started, and was engaged in that business at the time of the explosion, no other cause need be sought. What gives some probability to this theory, is that a wrench which he was accustomed to use for such purposes was found near his body after the explosion.

Boiler No. 1 appears to have exploded first, and started off its companion No. 2. The breaking of the steam connections caused such a sudden release of pressure that Nos. 7 and 8 were sent flying off toward the old distillery, a stone building with walls 2 feet or more thick, as shown in the figure at the left-hand side; they tore a large hole in the wall, indicated at A, Fig. 1, while Fig. 2 represents the appearance of the boilers as they were left projecting out of the wall. Boiler No. 1 passed along by the blacksmith-shop, taking off part of its cornice; it then passed through the roof of the nail mill, and declining somewhat, crashed into the shorehouse, through several piles of kegs of nails, and out through an 18-inch brick wall, resting as shown at C, Fig. 1, while Fig. 2 shows its situation in detail. Boiler No. 2 rose not less than 60 or 75 feet into the air, passed over the nail works and storehouse, crashed through the ventilator of the new mill, fell into a vacant lot, rebounded and landed near a private dwelling. Its position when found is shown at D, Fig. 1.

It is not often that such destructive explosions occur, but they go to show that the best managed establishments are sometimes liable to destructive accidents. It should be stated that boilers 3, 4, 5 and 6 remained undisturbed, with their stacks perpendicular and in good condition. This is a strange fact, when we consider that the portion of the mill in which they were located was entirely demolished, as shown in Fig. 4, which gives a general view of the appearance of the rolling mill after the explosion.

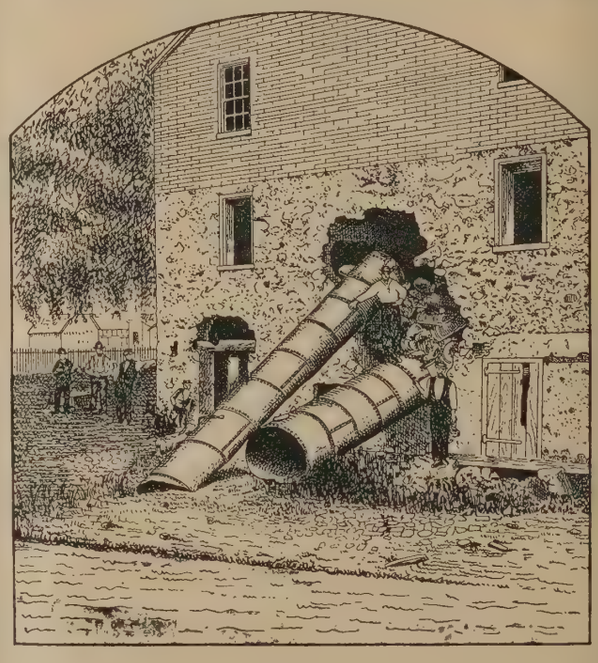


Fig. 2.

Too much importance cannot be placed upon the matter of opening the steam-ways between boilers that are under different pressures. Serious accidents not infrequently occur from carelessness in this matter. The openings should be made very gradually, the steam being almost or quite "wire drawn" until equilibrium is established. The man who had charge of the feed and steam connections had been in the employ of the company for many years, and is said to have been a sober, careful and faithful man. After careful examination, it was clear that no blame could be attached to the proprietors, but that the accident was entirely due to want of care of an employee whose carelessness cost him his life.

The Great Balloon for Transatlantic Travel.

The centennial of Montgolfier's invention is to be celebrated in France in 1883, but before that time—perhaps in 1880—the American Aeronautic Society hopes to have a balloon completed fully competent to solve the problem of transatlantic aerial navigation.

This society has its headquarters in Philadelphia, and its principal man is Prof. Samuel A. King, the well-known aeronaut. His workshop is the splendid dancing hall on the second story of the Stock Yard Hotel, situated near Fifty-second street and Lancaster avenue, half a mile beyond the Centennial buildings. This hall is 135 × 65 feet, and entirely occupied by sewing machines, seamstresses, painters, and the cloth of which the balloons are being made.

For eight weeks Prof. King has been making the two largest balloons ever seen in this country, and they are not nearly finished yet, though a very considerable hole has been made in a bank account of $10,000 to pay for the material upon which forty men and women have been working ten hours a day. In the first place, a little more than 8,000 yards of the best Belfast linen that could be procured has been cut up and stitched. The balloons will be 65 feet in diameter, 205 feet in circumference, will contain 144,000 feet of gas, and, when inflated, will stand about 80 feet in hight. In making a balloon, the first thing is to cut the cloth; one pattern is all that is needed; it is only a single strip of brown paper 102 feet long and 3 feet in width in the center, tapering down to a point at each end. Twenty-three of these strips having been cut out with mathematical exactness, they are handed over to the seamstresses, and the sewing machines make quick work of the long seams, though it is no such work as any one can do, for the cloth has to be doubled so closely and nicely put together that there must not be a wrinkle in the whole. For the purpose of handling with more ease and less risk of tearing or ripping it is made in halves, which will not be joined together until the painters have entirely finished their work. The whole surface is lined out with papier-mache patterns in the first place, and then begins the ornamentation with paints mixed with gum arabic. The top is silvered over, so as to present a dazzling appearance when exposed to the sun. Just below the center is a broad band 12 feet in width, on which is the name "Pioneer" in letters 8 feet high. The name, large as it is, does not take up the whole of the 205 feet circumference, and there is room enough left for the painter to delineate a remarkable painting of Columbus on board ship seeking the New World. This is in a medallion, with a figure of Boreas on either side, and allegorical figures of Europe and America kept cool by the breeze blown from the nostrils of the wind god. The background of this band is black and yellow, and the prevailing color of the lower part of the balloon—which is painted in panels converging into a point at the neck—is blue. The whole circumference is painted over thickly for the double purpose of protecting the cloth and making the balloon look showy. This adds enough to the weight to make it turn the scale at 1,000 pounds; but it has yet to receive a coat of balloon varnish, which is oil boiled down until it is very thick, and the 4,200 yards of linen will then weigh fully a

ton. The balloon having been duly painted and varnished, the two parts will then be sewed together, and it is a job that the seamstresses have already begun to dread. Working at such an enormous mass with double thicknesses is bad enough, but when it is made twice as thick and hard with paint and varnish, it will offer a sturdy resistance to any needle unless driven by an unrelenting thimble. Then will come the netting, which has already been made. No inflated balloon ever yet escaped from its netting, but Professor King proposes to make assurance doubly sure and will put an additional netting over the two balloons. The inner one is of cotton webbing, 1¼ inches thick, sewed together diagonally, just as the netting is made; over this will go the ordinary netting of twine. The car will be fastened to the latter, but it will also be firmly attached to the inner netting, the ropes being left slack. Then the aeronauts will be ready for the basket, which a Brooklyn (N. Y.) rattan factory is now building; it will be oval in shape, weigh 250 pounds, and capable of holding fifteen persons without undue crowding.

The structure from which the ascensions will be made is now being built at Coney Island; it is just beyond the Manhattan Beach Hotel, at the terminus of the road, sheltered on one side by the hotel and on the other side by the bathing pavilion. It is to be 200 feet in circumference and 35 feet high, floored over, and with a gallery about 12 feet above the floor, which will be roofed over so as to afford a protection from the weather, from which those in the center of the enclosure will be deprived. Outside will be a 30 horse-power engine for hauling down the balloon and making the gas. Two kinds of gas will be used—pure hydrogen, which will be made by passing steam over iron turnings, and an impure hydrogen, which is made by passing steam and hot air alternately through incandescent coal. The lifting power of the impure hydrogen, which can be made for 12½ cents per 1,000 cubic feet, will be about 37 pounds, and of the pure hydrogen, which will cost twenty times as much, about 70 pounds. The balloon itself will weigh a ton, the nettings 600 pounds, the basket 200, the cable—1½-inch hawser 1,200 feet long—1,000, and the fifteen passengers about 2,250 more, making a total weight to be lifted of a little more than 6,000 pounds. The balloon, containing 144,000 feet of pure hydrogen gas, will have a lifting power of 9,000 pounds, but if impure gas is used it will only lift 5,000 pounds; it will therefore be necessary to infuse enough pure gas to give a lifting power of about 55 or 60 pounds to the 1,000 feet. The leakage is estimated at not more than one per cent a day, so that it will not be necessary to make gas more than once or twice a week.

The establishment of this enterprise is for the purpose of making experiments preparatory to a trip across the Atlantic during the summer of 1880. Of course Prof. King will not refuse the $5 that every passenger will pay, but he will make money-getting a secondary consideration. The balloon will go up whether there are any passengers to go or not, and it will remain in the air for fifteen minutes or an hour, according as may be desired. It will go up at first about 1,000 feet, but if well patronized by the visitors to Coney Island, it will be permitted to ascend higher and higher until it attains a hight of about a quarter of a mile. Between the balloon and the cable will be a dynamometer, by which will be registered the lifting power of the air-ship at all times and under all circumstances. The purpose is to ascertain the lifting power with a given quantity of gas, and to determine as near as possible how it is affected by different atmospheric changes. It is hard to calculate anything more delicate than this; a balloon free in the air is in a state of perfect equilibrium, and is affected more easily than the most sensitive scales. Throwing out the least weight will cause it to rise, and a chill in the atmosphere, however slight, will depress it. When a balloonist has learned how to calculate the atmospheric changes with perfect accuracy he can tell just how long his balloon can be kept afloat.

Prof. King's theory of a transatlantic voyage is essentially different from that usually adopted, namely,

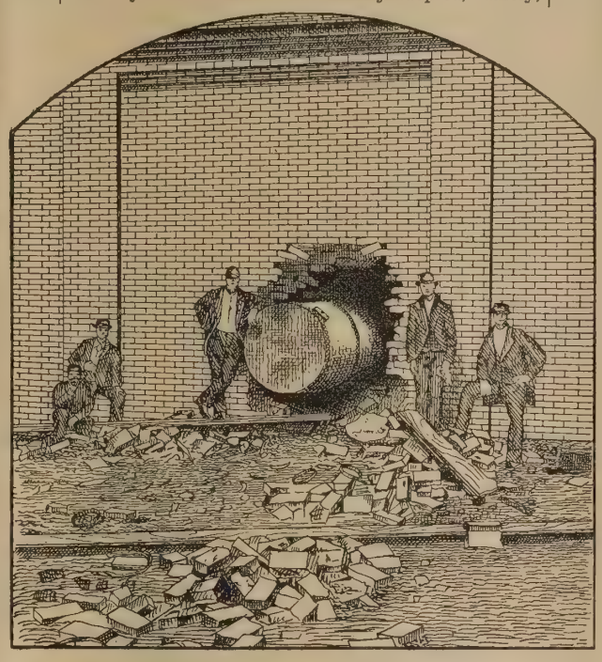


Fig. 3.

to take advantage of the strata of air currents, knowing that they are seldom half a mile in thickness, and that by ascending or descending a quarter or half a mile it is almost always possible to reach a current

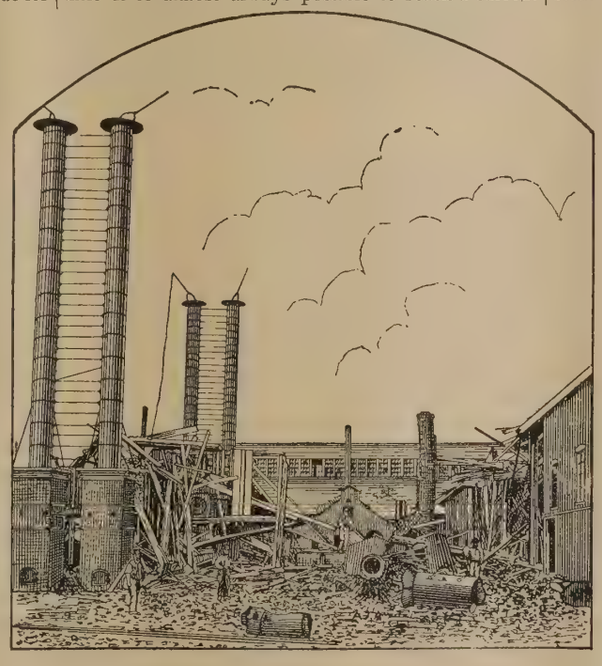


Fig. 4.

going in the right direction. Prof. King will try to cross in accordance with the theory of the westerly current, which prevails nearly all summer. He will carry just enough drag rope never to be cut free from the surface, and trust to the prevailing current to take him across, even if he has to take a month on the voyage. He intends to find out with as much exactness as possible just how much rope he must carry to prevent the balloon from lifting the whole of it out of the water at any time, and yet not enough ever to pull him down to the surface of the water. This is a matter that can only be determined by long and careful investigation and constant recording of results.

A Peculiar Disorder of Bank Clerks.

According to the *British Medical Journal*, Dr. Manouvries has published in the *Bulletin Médical du Nord* some novel observations on a disorder to which bankers' clerks are subjected under certain circumstances. It has been repeatedly noticed for years, that after having handled for some days in succession large quantities of silver five-franc pieces the clerks suffer from disturbances of the respiratory and digestive organs. These troubles have been ascribed to a dark greenish metallic dust, which is raised by taking the coins from the bags in which they are usually kept, weighing them, and putting them back. This dust impregnates the atmosphere of the room, blackens the skin, and penetrates into the respiratory and digestive tracts together with the air and saliva. As a rule, this process is only gone through at rare intervals during the year, and lasts only a few days, so that the clerks soon recover their health and do not feel much affected by this dust. But in the years 1872 and 1874, when the money which had been paid by France to Prussia as a tribute was returned to France through mercantile transactions, the clerks spent several weeks in handling the coins, which had not been taken out of their bags in some years, and the affection spoken of above was then more marked than ever.

The symptoms of this peculiar disease are frequent sneezing, coryza, and angina; the expectorations are black. There is a disagreeable metallic taste in the mouth, spoiling the flavor of food, producing loss of appetite, colic, nausea, and violent thirst. The bowels are mostly constipated; diarrhœa seldom prevails. The blue line along the gums, which is often noticed in patients who have been subjected to treatment by silver, is absent. There is great feeling of prostration and frequent headaches.

Owing to the peculiar circumstances under which this affection was first observed, there can be no doubt as to its being due partly to the copper (verdigris) and partly to the oxidized state of the silver; both metals are used in the coinage of the five-franc pieces, in the proportion of nine-10ths of silver to one-10th of copper. The constipation seems to be caused by the silver, because copper invariably causes diarrhœa. It is also said that silversmiths often suffer from colic, which is caused by their work. The patients were treated with purgatives and a milk diet, and the disorder soon ceased.

Bad News in Regard to the St. Gothard Tunnel.—There seems to be a very great chance that it will prove as difficult a thing to complete the St. Gothard tunnel as it was in Massachusetts to finish the Hoosac tunnel. Begun in 1871, for the purpose of making the route to Italy by the St. Gothard pass as attractive as it formerly was, by reason of the famous diligence road, which was built in 1830 at a cost of $375,000, and which had made this the favorite road until the Mont Cenis tunnel diverted both travel and traffic from this part of Switzerland, its estimated cost was $37,400,000, and the time for its building was limited to ten years. To build this tunnel, which would be 9¼ miles long, together with the railway, Germany and Italy agreed to subscribe $17,000,000, while the balance was to be raised by the Forest Cantons and the Federal Council. As the work has gone on it has been found that the estimated cost would be probably about half as much as the real cost, and as Switzerland has suffered as much from hard times as other countries, it is found that the work must be aban-

doned—for a time at least. Not long ago an endeavor was made to obtain a supplementary grant from the Canton of Zurich in aid of the enterprise, but when it was submitted to the popular vote its defeat was so decisive that the present prosecution of the work seems impossible, for the Canton of Zurich is at once the richest canton and the one which would be most benefitted by the new route.

Determination of Fire-Damp in Coal Mines.

The recent occurrence of explosions of the combustible gases evolved in coal mines, thus far free from them, is attracting the attention of mining engineers and of European governments to this subject. From every point the matter is studied and experimented upon, so as to find the means of preventing the terrible accidents to miners, which daily become more frequent. Among the investigators some give their attention to better ventilation, others to the study of the properties of explosive gases, and still others to the chemical analysis of fire-damp, which, when mixed with air, forms an explosive mixture. Among the latter M. J. Coquillion in France is one of the most industrious. Recently M. Chevreul presented to the French Academy of Sciences the results of experiments made by this investigator on mixtures of air with fire-damp, from which the following conclusions are drawn:

1st. Explosions of mixtures of fire-damp and air are produced between much wider limits than thus far has been supposed. It was thought that the presence of very nearly one-tenth or 10 per cent of fire-damp was necessary, but M. Coquillion has proved that even less than one-16th part of fire-damp in the air may produce an explosion, while the explosive quality is maintained in a mixture containing as much as one part of fire-damp to five of air, so that the explosive limits run between 6 and 16 per cent of fire-damp.

2d. It is sufficient to produce an explosion if anywhere in the mine small quantities of a mixture exist which is within these limits; if taking fire from any cause, the explosion will be propagated by the coal dust present, and by fire-damp mixed in other proportions.

3d. There exists no absorbent for this gas, but there is a metal which, when heated to a red heat, burns the gas without causing an explosion. If the experiment is made in a glass tube, the gaseous mixture diminishes in proportion as indicated by the theory. This metal is palladium, and the remarkable property referred to has been applied by M. Coquillion for the construction of an instrument which in French is called "grisoumeter," which means fire-damp meter.

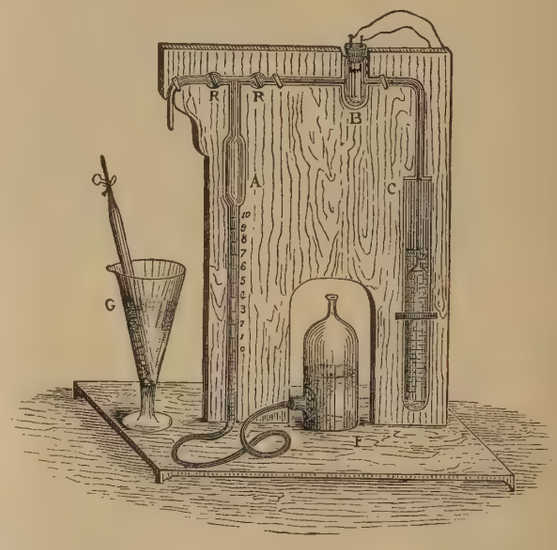
Two months later M. Coquillion presented to the Academy two of these instruments, which essentially were nothing but eudiometers modified, and especially designed for the purpose under consideration.

One of the instruments is intended to be used in the mine itself; the other is intended to verify the first, and can be placed in the office of the engineer or superintendent, who, without leaving his room, can observe the increase or extension of fire-damp in a gallery, and consequently can take such precautions as the circumstances require.

The first instrument mentioned consists of a small funnel with a narrow tube attached, similar to those used in chemical laboratories, open below, and covered at the top with a rubber stopper perforated with three holes, one of which remains open, while the other two are provided with metallic rods, carrying at their lower parts, inside the tube, the ends of a palladium wire, and at the upper end the electrodes of some generator of electricity, arranged in such a way that by turning a knob the current can be passed through the palladium wire. The tube and funnel are placed in a cylindrical glass vessel, protected by a metallic envelop with holes in it, so as to allow the interior to be seen.

In order to test the air of a mine, the tube and surrounding glass cylinder are filled with water and taken to the locality where the air is to be tested; arrived there the tube is partially lifted out of the water, when the latter will run out below and the air of the mine supply its place through the upper free opening in the rubber stopper. This opening is then closed with a small, well-fitting glass stopper, which entraps the air of the mine; the palladium wire is then made red-hot by turning on the electric current; it will burn the gas gradually, and after allowing the apparatus to cool, the amount of decrease in volume is noticed through the openings in the metallic envelop. The electric apparatus may form the base of the whole arrangement, of which the hight is about 2 feet. It may be suspended from a hook, or placed on top of a stick. The time required for a test is from 2 to 3 minutes.

We have not represented this apparatus by an engraving, as it is so simple that it may be easily understood from the above description. The second instrument, to be used in the office, is based on the same principle, but a little more complex, and is represented on this page. It is capable of giving the proportion



of fire-damp in a mine to within the one-thousandth part. As an accessory to its service, a small box containing a dozen small cylindrical tubes filled with water, is carried to different parts of the mine and the tubes are emptied there, when they become filled with the air of the locality where the water was poured out; they are then closed and brought to the office of the engineer to make the analysis.

The apparatus consists of a glass tube A, serving as a measure; it is, in fact, a pipette, the lower end of which is bent at a right angle, and to it a rubber tube is attached, connecting it with a bottle F half filled with water, which serves as an aspirator or blower, in proportion as it is placed lower or higher than the pipette A. The upper part of the same is attached to a T pipe furnished with cocks R and R′; at one side the tube is bent downward so as to attach one of the cylindrical tubes containing the gas to be analyzed. This tube is furnished with a rubber tube attachment closed by a clamp at one end, while the other end is plunged into a vessel containing water. B is the burner, consisting of a short tube in the form of a thimble; it is closed by a rubber stopper perforated by two stout copper wires, the ends of which in the tube carry a spiral of palladium wire, which lies in the passage-way of the gas. This tube B has two side branches; one, at the left, is connected by a piece of rubber tubing to the measuring arrangement; the other, at the right, ends in a capillary tube, surrounded by a cylinder filled with water, where the gas can be stored. The whole is fixed to an upright board supported upon a platform.

The use of this instrument is quite simple; the tube containing the gas to be analyzed is attached to the point of the measuring tube, previously filled with water; 25 cubic centimeters of the gas are then inhaled by opening the stop-cock R and lowering the aspirator bottle F; the stop-cock R is then closed and R′ opened, the spiral palladium wire is then made red hot by the voltaic current, and by elevating the aspirator bottle F the gas is driven through the tube B along the heated spiral, the aspirator is then lowered to pass the gas backward, and this is repeated several times, to make sure that every particle of fire-damp has had a chance to come in contact with the spiral and be burned—that is, changed into carbonic acid and water. As this combustion, however slow it may be, raises the temperature, the volume is not read off in the measurer before all is cooled. The gradation of the scale is made in such a way as to furnish the amount of fire-damp to within one-tenth of one per cent.

In order to determine the amount of carbonic acid in the product of combustion, a tube containing caustic potassa may be attached in such a way as to pass the gas repeatedly over or through the same, in the manner it is passed during combustion along the palladium spiral wire. This caustic potassa attachment makes the apparatus adapted to the determination of all carburetted gases in general, and is now being applied to the analysis of the gases produced in the Siemens furnaces.

M. Coquillion has experimented with this apparatus in various shafts of the mines of St. Etienne in France, while there and elsewhere investigations are now being industriously prosecuted. As the results obtained are very correct and reliable, it is hoped that the knowledge of the laws concerning the distribution of fire-damp in mines may lead to better and more extensive methods of ventilation.

Notwithstanding it is not pretended that these labors will lead directly to a suppression of the development of fire-damp, they are of great value to the mining interest, as they will give warning in regard to the localities where the greatest danger is lurking, and the use of the instrument described will contribute largely to the preservation of life and prevent damage to property. For this reason the French government and the Consul-General of mining operations actively encourage M. Coquillion in his researches.

Quite recently he has introduced his apparatus in coal mines of Belgium, where the engineers were intensely interested in the new method. They declare that thus far the only way practiced to attain a rough estimate of the amount of fire-damp present is the safety lamp. If the wick is lowered below the yellow part of the flame, a small bluish flame appears, which is more sensitive in proportion to the greater amount of fire-damp in the surrounding atmosphere. They endeavored to ascertain whether the different safety lamps were comparable in this respect; one engineer was provided with an original Davy lamp, another with a lamp of Muesler, another with the lamp as carried by the head miners, etc., and every observer measured the hight of the blue flame when estimating by it the amount of fire-damp. The result was that it was proved that the different lamps were not at all comparable; they disagreed, and therefore could give no exact results. The apparatus described will probably lead to the construction of a standard lamp of which the indications will be reliable.

At Charleroi the experiments of M. Coquillion had another purpose. M. Castel had announced that in the mine there the fire-damp very imperfectly obeyed the law of the diffusion of gases, and M. Coquillion wished to ascertain if this fact could be verified by means of the lamp. For this purpose, the evening previous to the experiment one gallery containing fire-damp was withdrawn from the general ventilation by closing it. M. Coquillion entered with two mining engineers; the further they advanced the amount of fire-damp was found to be greater. After going a certain distance, they took particular precaution so as not to disturb the air and cause the gases to mix by the disturbance; the lamp was carried usually on a level

with the floor, by means of a long pole at a distance in front of the observers. When the lamp was raised the blue flame enlarged in proportion as it was raised higher; at the top of the gallery the lamp was extinguished from want of air, proving that the amount of fire-damp there was very great. It was found that when the air was left in a state of rest for twenty-four hours, the fire-damp was found separated from the air along the top of the gallery.

It is not merely a scientific question that is to be solved. For a long time a relation between a descent of the barometer and an increase in the development of fire-damp has been announced. This fact is in accordance with the scientific consideration that a diminished atmospheric pressure will allow an expansion of the gases confined in coal seams, which will cause their escape. Notwithstanding experience and theory agree in this respect, it is controverted by many, and the opinions of mining engineers vary on this point. The instrument above described will permit the definite settlement of this question, and it actually fills a want, as thus far there has been no practical apparatus by which to measure the amount of fire-damp so correctly as can be done with this apparatus.

The knowledge of the composition of the air in a mine will certainly not prevent explosions if nothing is done to change the ordinary conditions of the same. But when, after the eudiometric analysis has proved the presence of fire-damp in dangerous quantities, a more energetic circulation can be provided, capable of a more rapid change of air, and if the workmen are warned to use extra care, many terrible catastrophies can be prevented.

If the apparatus of M. Coquillion only secures these results, he will well deserve the gratitude of the mining interest and of humanity in general.

Scientific.

The Nature of Yellow Fever.—The United States Senate has passed a bill appropriating $200,000 for the construction of a steel refrigerating ship to disinfect the holds and cargoes of vessels coming from infected ports. This action is based on the theory that yellow fever is propagated by germs which cannot withstand a freezing temperature, and is on this ground criticised by some of the papers, which maintain, first, that the germ theory is false, and second, that it is not proved that frost destroys yellow fever infection.

These same papers, however, allow the germ theory by stating that "an undetermined something, under favorable conditions, not fully understood, suffices to propagate the disease;" and further say: "It is also true that yellow fever epidemics in this country are stopped by cold weather." But then the case of the United States steamer "Plymouth" is cited. Yellow fever had been on board the ship, and she was sent to Boston to spend the winter, and was frozen and fumigated; still, after leaving Boston in March and arriving in Southern waters, the fever broke out again, and the steamer had to return.

We do not see how this is any argument against the germ theory; it only proves that the freezing and fumigating were imperfectly done, and any one familiar with the interior of an ocean steamer, and with practical fumigation, will easily understand how some places in the vessel could escape its influence, as well as that of the cold.

While we do not approve of the plan according to which the $200,000 are to be spent, we do not oppose it on the ground of the falsity of the germ theory, but on the ground that it is entirely unnecessary to build a new steel steamer for the purpose of testing the freezing method. The better way would be to obtain the most perfect refrigerating and freezing apparatus, and place it near, on, or in the first infected vessel arriving, forcing refrigerated air currents through all its parts, and combining refrigeration with other disinfecting agents, if judged advisable. Surely one steel steamer would be utterly inadequate for the work should many infected vessels arrive, and the $200,000 could be much more advantageously employed in the way indicated by us.

In regard to the opposition to the germ theory, we wish to remark that such opposition is chiefly based on negative proofs, which are no proofs at all. We remember the time when many physicians denied the existence of the itch insect, because, forsooth, they had failed to detect it by the microscope; and this failure, it is now acknowledged, was caused by their ignorance in manipulating the instrument and making microscopic investigations. So it has been with various other discoveries with the microscope which expert microscopists have made, and which were denied by less expert ones, for the same reason mentioned above.

In the course of time the reality of the organic germs as the cause of various ailments have been demonstrated, and to these will no doubt be added that of yellow fever, which behaves so much like other ailments propagated by organic germs, that by analogy we are forced to the conclusion that the germs certainly exist, and their actual observation may at some future time be announced.

Pasteur's Theory of Fermentation.—It is well known that the great French chemist, Pasteur, holds that ferment is a germ which propagates in the fermenting liquor, and its growth is the cause of the gradual changes produced during the process of fermentation. Dr. Claude Bernard having expressed the belief that alcoholic fermentation was an inherent quality of the juice of the grape, and, in fact, of all over-ripe or decaying substances, M. Pasteur determined to undertake a course of experiments which should finally establish the opposite theory, advocated by himself, that the phenomenon in question is produced by numerous minute cellules of yeast, which are prevalent in wine-growing districts about the time of the ripening of the grape, and are carried about by the air and deposited on the fruit, so as to be ready when that is crushed to set the desired fermentation in motion. M. Pasteur states that these spores are non-existent while the grape is in its green state; and to prove the correctness of his views, he adopted the following plan: He caused several glass cases to be made, which he conveyed to the Canton of Arbois (Jura) in the beginning of August. As the season was late, the grape had not then passed the green stage. Having examined minutely several vines, and satisfied himself that none of the cellules were as yet existing, he carefully covered them and hermetically closed the cases. Not being willing to run the risk of any accident, he carefully enveloped several bunches in each case in cotton wadding which had been previously heated to 150° 200° C., in order to destroy any germs which might possibly exist. In October, when the grapes ripened, he took some bunches from the unprotected vines, and having pressed out the juice, he obtained, as he expected, the action of fermentation in 36 to 48 hours. The case was very different with those grown under his glass; neither those wrapped in cotton, nor those hanging free in the sealed glass case, when crushed, presented any symptoms whatever of alcoholic fermentation. M. Pasteur recently laid before the Academy of Sciences specimens of the grape in each condition, in order that such of his colleagues as felt so disposed might test the experiment for themselves.

The Poison of the Rattlesnake a Ferment.—Hitherto the general belief has been that the poisonous matter secreted by certain species of reptiles was nothing more than a poisonous saliva, acting in the manner of ferments. M. Lacerdo has been making, at Rio de Janeiro, some researches into the action of the venom of the rattlesnake, which throws much new light on the subject. His investigations show that the saliva contains what are called figured ferments, the analogy of which with bacterides is very remarkable. From a young and vigorous *crotalus*, subjected to the action of chloroform, he obtained a drop of the venom on a chemically clean piece of glass, and at once placed it under a microscope. Almost immediately he observed the formation of a filamentous pulp in an arborescent disposition. Gradually the thickened filament, after having pushed out spores, dissolved and disappeared, and the liberated spores swelled and enlarged visibly, each of them sending out a minute tube which lengthened rapidly. After a very short period the latter separated from the first spore, and constituted another nucleus for engendering the deadly contamination. In the examination of the blood of animals killed by the bite of one of these snakes, M. Lacerdo noticed that the red globules of the blood commenced to change by presenting some small, brilliant points on the surface, which spread with great rapidity, and ultimately the globules melted one into the other, forming a sort of amorphous paste which could no longer circulate in the veins. Other animals, in which that blood was injected immediately after the death of the first, expired in a few hours, presenting all the symptons of having themselves been bitten, and their blood always showed the same alteration. M. Lacerdo concludes his memoir by stating that numerous experiments have shown that the true antidote for serpent-poisoning is the injection of alcohol under the skin, or its administration through the mouth.

Scandium the Latest New Element.—Spectroscopic observations have again led to the discovery of a new metallic element. As it is of Scandinavian origin the name Scandium has been given to it. This makes the seventh new elementary substance of which we owe the knowledge to the spectroscope, the first being rubidium and caesium, then indium and thallium, more recently gallium and phillipium, and lastly scandium. This is present in erbium, a mineral of rose color, being the oxid of the rare element erbine, while in the supposed impurities of this mineral ytterbine has been discovered. These supposed impurities have lately been submitted to a further careful investigation, and the result has been to define small quantities of different minerals which have been called gadolinite and euxinite. The pure ytterbine is white, and the spectroscopic bands of the metal of which it is the oxid have been investigated, and were known, but Mr. Nelson found that in the ytterbine of these Swedish mines spectroscopic bands were seen, different from any substances thus far investigated, indicating therefore the existence of a substance heretofore unknown.

His investigation has not progressed far enough to say all about the properties of the new metal, but as thus far found out it will fill the gap between tin and thorium, the atomic weights of which are 118 and 236, while that of scandium will be about 176.

Gallium, the new metallic element lately discovered in France by M. Lecoq de Boisbaudran, is one of the most remarkable substances known. Its color is nearly like steel; it is harder than iron, but brittle when cold; it fuses at the remarkably low temperature of 90° Fah., so that it melts by the heat of the hand. This low melting point renders it valuable to make easily fusible alloys, and it has thus been applied for the practical purpose of an automatic fire alarm by the editor of this journal, which alloy, by its fusing at a temperature of from 110° to 130° or 140°, causes a mechanical fire alarm to be sounded on the premises, or an electric alarm to be transmitted at any distance.

As this metal is not volatile, like mercury, it is proposed to use it for a thermometer, starting at 100° Fah., and going up to a red heat, or about 1,000°, or even as high as hard glass can stand without fusing, which is not the case with a mercurial thermometer, which becomes useless at about 600°, the boiling point of mercury, which even volatilizes far below that temperature.

The discoverer lately exhibited before the French Academy a bar, a sheet, and octahedral crystals of this metal, of which he determined the chemical equivalent to be 70. The only drawback to the extensive use of a substance of such valuable qualities, will probably be its high price, as the amount of ore treated to furnish 60 grains of the metal was 5 tons; but then this ore furnishes large quantities of other metals, while during its treatment the gallium is extracted by a kind of incidental process.

Post Boring Machine.

One of the objections to the ordinary large size boring machines is their expensiveness; this is a necessary consequence of having the working parts attached to an elaborate cast-iron column for support, which has to be made so as to furnish a perfect fit for all the attachments. For this expensive part of the machine a simple wooden post can be substituted, which, by its original inexpensiveness, secures the additional economy that any piece of machinery can be easily attached to it at any part where it is desired.

The post boring machine represented in Fig. 1 is constructed according to the above suggestions; it is from the well-known house of Walker Brothers, of 73 and 75 Laurel street, Philadelphia, Pa., who for a long time have distinguished themselves for the excellence of their wood-working machinery. This machine is especially adapted for machine-shops in which the extra large, heavy sizes are not required, and where economy is an object.

The belt driving it comes directly from the main line of shafting, either above or below, or from any convenient counter-shaft. It has fast and loose pulleys, and the spindle is worked up and down, either by hand or foot, as desired. It will bore holes up to 1¼ inches, and 9 inches deep, and is provided with a stop-gauge for any depth less than 9 inches. As it has no gearing, it runs quite smoothly at any speed required.

Improved Wood-Turning Lathe.

The majority of experienced wood turners prefer a lathe with a wooden bed, especially those who have to turn bulky objects—of say 2 feet in diameter. If this wooden bed, however, is supported upon wooden legs, the lathe does not possess the firmness of a massive iron support.

The lathe represented in Fig. 2, which is manufactured by Walker Brothers, of Philadelphia, combines the advantages of the wooden bed with those furnished by heavy iron supports, which possess the additional advantage of being much easier screwed to the floor than those with wooden legs, and in this way subject the work to no possible vibration. This screwing to the floor is especially necessary when the lathe is to be driven by a belt from above. The counter-shaft, with its set of pulleys, fixed and idle, bearings, etc., to be secured to the ceiling overhead, is represented standing on the floor under the lathe; also the chucks, rest, etc., while at the left is represented an extra support for the rest, necessary when turning large diameters, especially large circles or disks. It is used with one of the short rests, as shown in the cut, the large work being bolted to the face plate, and usually on a larger face plate of wood bolted to the smaller iron one. The rest, with two supports, (seen on the floor), is used with two stands on the lathe bed in case pieces have to be turned longer than the single rest will turn without moving them, which would be inconvenient.

There is a novel feature about these lathes; on the floor is shown a piece that screws into the end of the lathe-head when the rear face-plate is removed. This arrangement entirely covers the step and holds the oil that usually runs down all over the lathe, while the step or end bearing is running dry, and constantly giving more or less trouble. This combines the advantages of a rear face-plate with the advantages of a covered step that is constantly oiled. All these lathes are provided with means for keeping the end screw or step constantly lubricated.

It is evident that such lathes are eminently adapted for pattern work of various kinds. They are furnished in sizes of 12, 16, 20, and 24 inches swing. The beds are of wood, as here represented, or can be had of iron if desired. They are well fitted up, and run very steadily and smoothly.

Messrs. Walker Brothers manufacture many other kinds of wood-working machinery, and those desiring further information respecting their products, should address them as above.

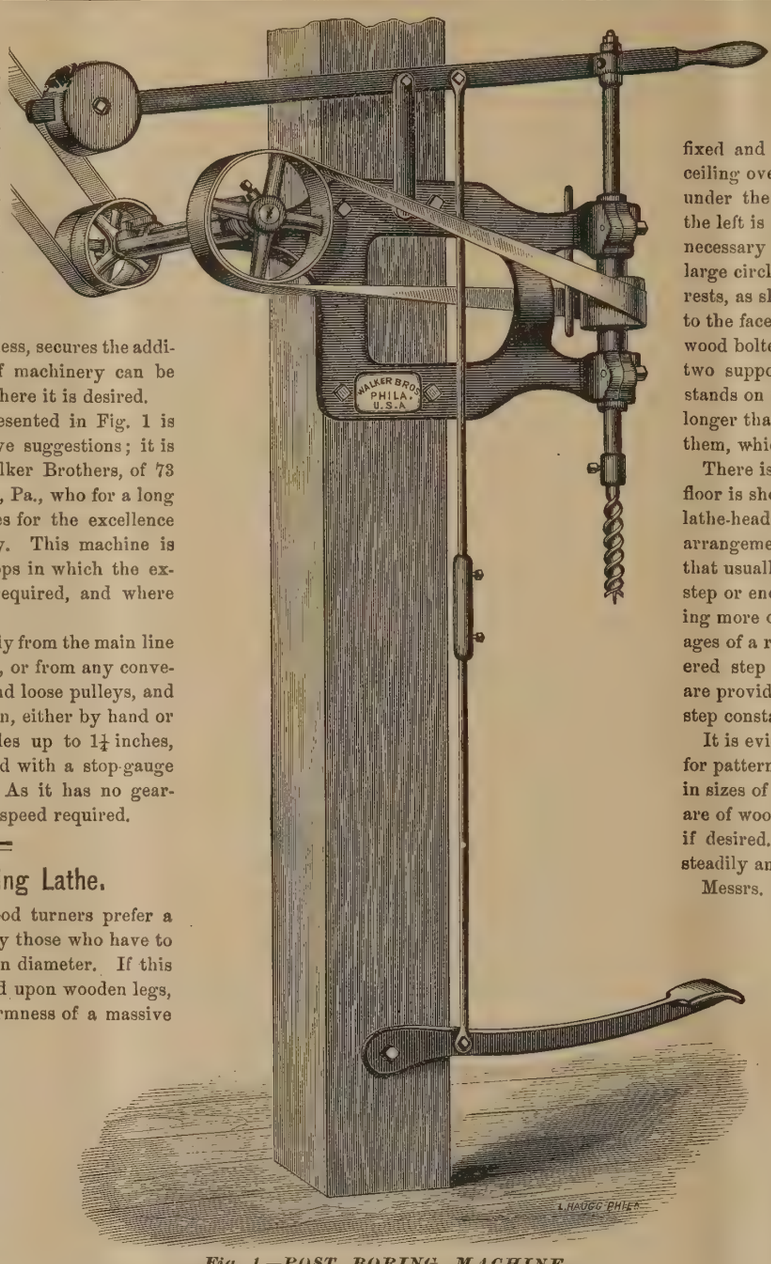


Fig. 1.—POST BORING MACHINE.

WELDING SILVER AND PLATINUM AT 900°.—Mr. Fawcet, of Glasgow, Scotland, has accidentally discovered that silver can be welded to platinum, copper and aluminum at an unexpected low temperature, namely, 900° Fah., thus far below the melting point of silver. Sir William Thomson considers it as a remarkable case of cohesion, or in fact, welding at a low temperature. According to Mr. Fawcet,

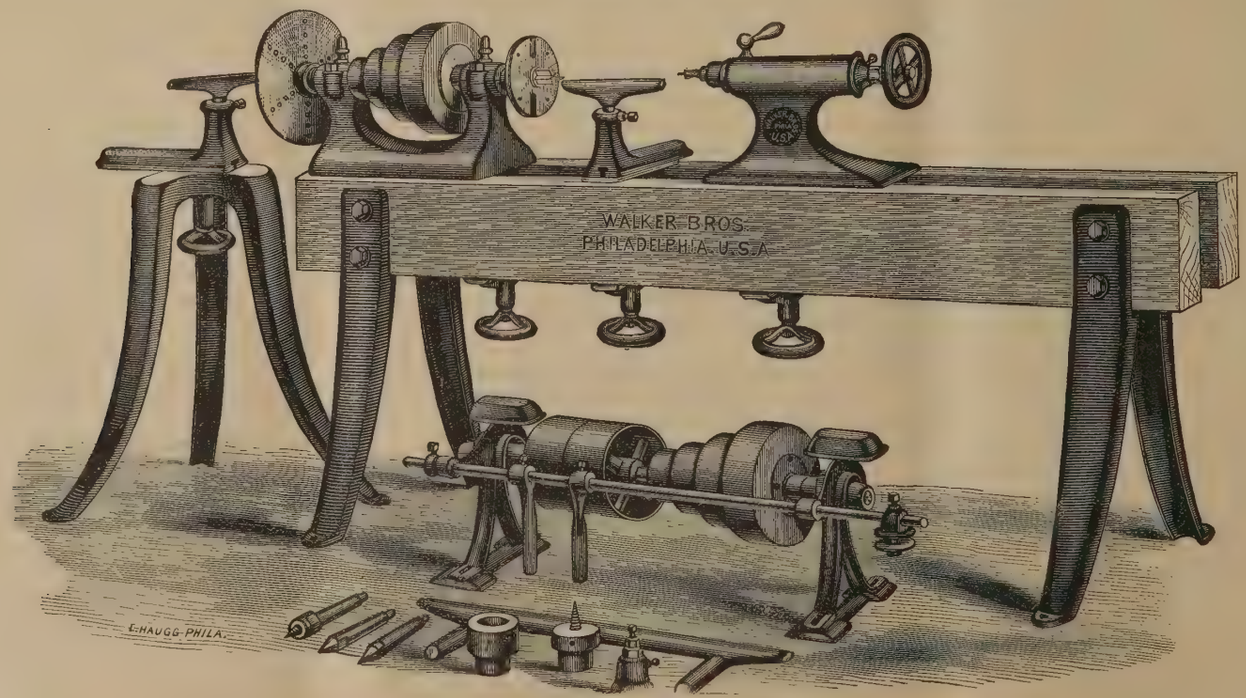


Fig. 2.—WOOD-TURNING LATHE.

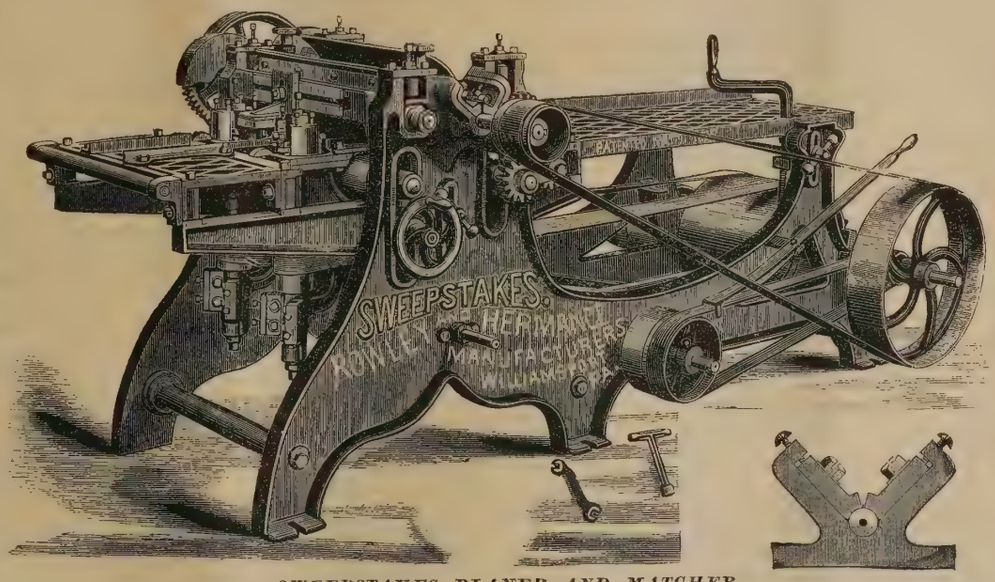
small pieces of silver foil can be welded at a much lower temperature, but the welding to platinum is better than that to the other metals named.

The Sweepstakes Planer and Matcher.

The first changes made in planing and matching machinery were all intended to fill the wants of those using them, and to improve on the various features, regardless of expense. The consequence has been that some of the machines became so expensive as to be beyond the reach of the ordinary means of those who most needed them.

Fortunately for the latter, a new era has sprung up. Some manufacturers of wood-working machinery have attempted to lower the high prices, or to make great improvements without making the machines more expensive. Among these we think the firm of Rowley & Hermance, manufacturers of wood-working machinery, of Williamsport, Pa., are among the foremost. They have brought out a machine (represented in the adjoined engraving) from which any planing mill man will see at a glance that it contains all that is essential to make a first-class machine, and that at the small cost of $300. This machine will plane any dimensions upward to 20 inches wide and 6 inches thick; will match 8½ inches in width, and weighs 2,100 pounds. For $50 more a machine of 2,500 pounds can be had, 4 inches wider, which will match 13½ inches wide.

This machine possesses the following very important improvements: It is of a new design, has a solid forged steel head, and steel matcher spindles, all running in the Ellis patent journal box, the details of which are shown in the small cut at the right hand below, and is made in three parts, so that the journal can be kept central and tight until the box is worn out, thus preventing all tremble and jar of the shaft, which is very important where smooth work is required.



SWEEPSTAKES PLANER AND MATCHER.

This machine can be changed to a surfacer only, very quickly by simply loosening two nuts, removing the heads, when the spindles will swing below the surface of the table. They can be swung back into position ready for work, without measuring or changing. There is also a shaft passing across the width of the machine, (not shown in the cut, and for which the manufacturers charge $20 extra), in the rear of the matcher heads, on which there is a head and cutters, which can be used for making rustic siding, beaded ceilings, small moldings, etc. It has four 4½-inch feed rolls, connected with expansion gear, making a powerful feed of 45 feet per minute. It has two pressure bars, one in front and one back of the head. The rolls are held down with forged steel coil springs, which are far superior to rubber or a weighted roll. The table is long, making room for a long gauge, which is indispensable on a good flooring machine. It has a heavy counter-shaft, with tight and loose pulleys 10 inches in diameter, 6 inches face, and should make 900 revolutions per minute.

By addressing the manufacturers as above, they will be pleased to give any further information that may be desired.

Caution.—All persons are hereby notified that Messrs. Rowley & Hermance have purchased the sole and exclusive right of the patent journal box referred to above, and will prosecute any infringement of the same to the full extent of the law.

The End of the Nickel Patent Lawsuits.

It appears that those manufacturers in the United States who practice nickel-plating, have given up the unequal contest against the United Nickel Company, backed as it was by plenty of capital and several judicial decisions in their favor—decisions which sustained the value of the Adams patent.

The result has been injunctions against all nickel-plating processes, no matter how done, and the sufferers concluded to submit rather than spend more money for defence. The organization of manufacturers (comprising forty of the largest firms in that line of business) have taken out licenses in a body under the Adams patent, and paid back-damages, a course which they found less expensive than to fight. The result is, of course, that their interest has become identical with that of the United Nickel Company, and the consequence will be the extinction of irresponsible parties doing poor work on an insignificant scale, and consequently better prices will prevail for nickel-plated goods.

It is for this reason that we call the attention of the trade to the fact that at present it is very risky to trust the statements made for numerous solutions, offered with guarantees of immunity from damages. As the matter now stands, after a six years' fight against the Adams patent, and the decisions rendered in its favor, nobody is safe, whatever may be the way in which he accomplishes nickel-plating, and the best way to keep out of trouble is simply to take out a license and pay a royalty to the United Nickel Company, (if any one wishes he may do this under mental protest).

Messrs. Condit, Hanson & Van Winkle, manufacturers of nickel and electro platers' material, of 236 Market street, Newark, N. J., will send their catalogue to all applicants. They have been licensed by the United Nickel Company for the manufacture and sale of nickel anodes, as shown by the following card:

OFFICE OF THE UNITED NICKEL COMPANY,
No. 239 BROADWAY, NEW YORK, June 1, 1879.

The United Nickel Company have this day granted to Condit, Hanson & Van Winkle, of Newark, N. J., the exclusive license for manufacturing cast nickel anodes, under their various patents, requiring from them a standard of quality that will insure the best results in the hands of our licensees, and at reasonable prices, to be governed by the market price of pure nickel. All nickel anodes manufactured by them hereafter will have the name of the United Nickel Company and dates of patents upon them; and we therefore notify all parties against manufacturing, selling, or using cast nickel anodes not made under our license.

UNITED NICKEL COMPANY,
ISAAC ADAMS, JR., *President.*

Messrs. Condit, Hanson & Van Winkle, who are agents for the Weston dynamo-electric machines, and the largest manufacturers of nickel material, have just opened a salesroom in New York city, at 92 and 94 Liberty street, (formerly occupied by the Knowles Steam Pump Works), where they show the Weston machines in operation for nickel-plating, and for gold, silver, copper and brass plating, and for the sale of their various manufactures, batteries, etc., and for showing the Weston electric light. They have also just issued a handsome catalogue, of 100 pages, containing all their apparatus, which is mailed on application.

Short-Hand Reporting.

The question is often asked: "Which is the best of the various systems of stenography in use?" The answer is naturally that the success of stenographers does not depend so much on the system they use as on their ability in its use, their knowledge of the subject they have to report, and the attention they give to the words they hear, so as to understand their meaning, and not mechanically repeat the sounds they hear, as in that case the sense is often changed, or even lost, so that the utterances have no sense at all.

The necessity of understanding the subject reported has caused the evolution of various kinds of reporters; some are best for reporting sermons, others, who are acquainted with law, are best for reporting law cases, etc. Of all subjects, political speeches are the easiest to report, and any short-hand reporter can keep notes of a political or Fourth of July speech. On the other hand, scientific subjects are the most difficult to report, as a reporter of this class must not only be familiar with scientific terms in general, but also with scientific theories — in fact, he must be to some extent a scientist himself; only then can he be expected to do justice to the subject he reports. Among all the American daily papers, it must be acknowledged that the *Tribune* and *Daily Graphic* have the most able scientific reporters and editors, and remain free from the blunders so often committed by the others, who frequently insert the most absurd nonsense, especially that written by correspondents. An able editor keeps trash out of his paper, and will not stick in worthless communications merely to fill up his columns. This is exactly what some papers do.

SOME GOOD RESULTS FROM THE BLUE GLASS DELUSION.—The blue glass mania, which has now almost disappeared, was not destitute of good results. It lead to a great deal of scientific study of the influence of certain rays of light on animal and vegetable life. There is a paper on the subject in the *Comptes Rendus*, by a French experimenter. He found that the blue rays are least necessary in spring and winter, while the red rays are more requisite to sustain life and prevent too rapid development. He notices the fact that most leaf buds have a brown or reddish covering. Red glass, by withdrawing the blue rays, sustains while it retards life; green glass, by intercepting the red rays, causes most plants to become weak, and ultimately to perish; while the unadulterated sunlight, as nature gives it, is the best of all, and cannot possibly be improved upon by colored glass; all that is sometimes needed is a little shade for delicate plants.

Latest Market Report of Building Materials.

NEW YORK PRICES.

ARTICLES MARKED WITH A STAR (*) ARE QUOTED IN GOLD.

—o—

LUMBER.

Pine, very choice and extra dry, per M	$55 00 a 60 00
Pine, good	45 00 a 50 00
Pine, shipping box	18 00 a 22 00
Pine, common box	16 00 a 17 00
Pine, common box, ⅝	13 00 a 15 00
Pine, tally plank, 1¼, 10 inch, dressed, each	40 a 43
Pine, tally plank, 1¼, 2d quality	35 a 38
Pine, tally plank, 1¼, culls	25 a 28
Pine, tally boards, dressed, good	28 a 30
Pine, tally boards, dressed, common	22 a 25
Pine, tally boards, culls, dressed	21 a 23
Pine, strip boards, merchantable	16 a 18
Pine, strip boards, clear	22 a 25
Pine, strip plank, dressed, clear	33 a 35
Spruce boards, dressed	18 a 20
Spruce plank, 1¼-inch, dressed	22 a 25
Spruce plank, 2-inch,	28 a 34
Spruce wall strips	13 a — 15
Spruce timber, per M	16 00 a 19 00
Hemlock boards, each	14 a — 16
Hemlock joist, 2½x4	15 a — 16
Hemlock joist, 3x4	16 a — 18
Hemlock joist, 4x6	40 a — 44
Ash, good, per M	30 00 a 50 00
Oak	32 50 a 65 00
Maple culls	20 00 a 25 00
Maple good	45 00 a 85 50
Chestnut	42 00 a 48 00
Cypress, 1, 1¼, 2, and 2½-inch	35 00 a 40 00
Black walnut, good to choice	85 00 a100 00
Black walnut, ⅝-inch	75 00 a 85 00
Black walnut, selected and seasoned	110 00 a150 00
Black walnut counters, per ft	12½ a 20
Cherry, wide, per M	85 00 a100 00
Cherry, ordinary	60 00 a 80 00
White wood, chair plank	60 00 a 70 00
White wood, inch	25 00 a 45 00
White wood, ⅝-inch	30 00 a 45 00
White wood, ⅝ panels	35 00 a 50 00
Shingles, extra shaved pine, 18-inch	9 50 a 10 00
Shingles, extra shaved pine, 16-inch	8 50 a 9 50
Shingles, extra sawed pine, 18-inch	7 00 a 8 00
Shingles, clear sawed pine, 18-inch	6 50 a 7 50
Shingles, cypress, 24x7	20 00 a 22 00
Shingles, cypress, 20x6	12 00 a 15 00
Lath, Cargo rate	1 35 a 1 40
Yellow dressed pine flooring	25 00 a 35 00
Yellow pine girders	30 00 a 40 00
Locust posts, 8 feet, per inch	18 a 20
Locust posts, 10 feet	24 a 25
Locust posts, 12 feet	29 a 34
Chestnut posts, per ft	3 a 3½
Basswood per M	25 00 a 30 00

Cargo rates, 10 per cent off.

BRICKS.

	Cargo.	Afloat.
Pale, per M.	2 50 a	2 75
Up River	5 00 a	5 25
Haverstraw Bay	5 37½ a	5 50
" " choice	5 62½ a	5 75
Favorite Brands	6 00 a —	—
Hollow Fire-Clay Brick	9 00 a	9 25

FRONTS.

Croton—Brown, per M.	7 00 a 8 00
" Dark	8 00 a 9 00
" Red	9 00 a 9 50
Philadelphia	26 00 a 28 00
Trenton	24 00 a 29 00
Baltimore	34 00 a 38 00

Yard prices 50 cents per M higher, or with delivery added $2 per M for hard and $3 per M for front brick. For delivery add $5 on Philadelphia and Trenton, and $6 on Baltimore brick.

IRON—PER TON.

Duty.—Bar, 1 to 1½c. per lb.; Railroad, 70c. per 100 lbs.; Boiler and Plate, 1½c. per lb.; Sheet, Band, Hoop and Scroll, 1¼ to 1¾c. per lb.; Pig, $7 per ton; Polished Sheet, 3c. per lb.; Galvanized, 2½c. per lb.; Scrap Cast, $6 per ton; Scrap Wrought, $8 per ton—all less 10 per cent. No Bar Iron to pay a less duty than 35 per cent ad val.

Pig, Scotch—Coltness	21 00 a 21 50
" Glengarnock	20 50 a 21 00
" Eglinton	19 00 a 20 50
" American, No. 1	17 50 a 19 00
" American, No. 2	16 50 a 17 50
" American, forge	15 50 a 16 00

	Store prices.	Cash.
Bar, Swedes, ordinary sizes	— 5 a	— 6
Bar, Swedes, nail-rod	— — a	— 6½

LEAD—PER 100 POUNDS.

*German	— — a — —
*English, common	— — a — —
*Spanish	— — a — —
*Foreign, refined	— — a — —
*Bar	5 00 a — —
*Sheet and Pipe	5 00 a 6 00
*Domestic	3 37 a — —

NAILS—PER KEG.

10d to 60d, common, fence and sheathing	2 30 a — —
8d and 9d, common	2 85 a — —
6d and 7d, common	3 10 a — —
4d and 5d, common	3 35 a — —
3d and 4d, light	4 10 a — —
3d, fine	4 85 a — —
2d, fine	4 85 a — —
Cut spikes, all sizes	2 85 a — —
Clinch nails, 1⅛ to 1¾ inch	5 00 a 5 25
do. 2 to 2¼ inch	4 75 a — —
do. 2¼ to 2¾ inch	4 50 a — —
do. 3 inch and longer	4 25 a — —

TIN PLATES.—Duty, 1 1-10 cents per pound.

*I. C. charcoal, 10x14, per box	6 25 a 6 50
*I. C. coke, 10x14	5 00 a 5 75
*I. X. charcoal, 10x14	8 25 a 8 50
*I. C. charcoal, 14x20	6 50 a 6 75
*I. X. charcoal, 14x20	8 25 a 8 50
*I. C. coke, 14x20	5 00 a 5 75
*I. C. coke, terne, 14x20	5 00 a 5 25
*I. C. charcoal, terne, 14x20	5 50 a 6 00

ZINC.—Duty, sheet, per lb., 2½ cents.

Sheet, (cask) per lb	— — a — 6½
Sheet, (open)	— — a — 7

SOLDERS.

No. 1	— 9 a — 10
No. 2	— 8½ a — 8¾

STONE.—Cargo Rates.

Amherst Freestone, in rough, per cubic foot	— — a — 85
Berlin Freestone, in rough	— — a — 95
Berea Freestone, in rough	— — a — 75
Brown-Stone, Portland, Conn	1 25 a 1 50
Brown Stone, Belleville, N. J	1 00 a 1 50
Granite, rough	— 60 a 1 25
Canaan Marble	1 25 a 1 50
Dorchester, N.B., Stone, rough, per foot	— — a 1 03

PAINTS.

*Carmine, American, per lb. gold	5 00 a 5 50
Chalk, per lb.	— 00¾ a — 00⅜
China Clay, per ton gold	20 00 a 22 00
Chrome yellow, dry, per pound	— 12½ a — 28
Lead, red American, per pound	— 7 a — 8
Lead, white American, pure, in oil	— 6½ a — 8
Lead, white American, pure, dry	— 6¾ a — 7¼
Lead, white English, pure, in oil gold	— 9½ a — 10½
Litharge	— 7 a — 8
*Ochre, Fr., dry, per 100 lbs	1 50 a — —
Ochre, ground, in oil, per lb	— 6 a — 15
Ochre, Vermont, per 100 lbs	— 75 a 1 00
*Orange Mineral, English gold	— 9½ a — 10
Paris White, American	— 1¾ a — 1½
Paris White, English, prime	— 1¾ a — 2
Paris Green	— 15 a — 28
Plumbago paint, patent, per lb	— — a — 25
Putty, per lb	— 1¾ a — 2½
Spanish Brown, dry, per lb	— 1½ a — 1¾
Spanish Brown, ground in oil, per lb	— 8 a — 9
Venetian red, per cwt	1 75 a 2 00
*Vermilion, Chinese, per lb	— 80 a — 90
*Vermilion, Trieste	— 70 a — 80
*Vermilion, quicksilver, bags gold	— 55 a — 57½
Vermilion, American, common	— 15 a — 18
Whiting, per 100 lbs	— 50 a — 75
Zinc, white American, dry, No. 1	— 5 a — 7½
Zinc, white American, No. 1, in oil	— 8 a — 10
*Zinc, white French, dry, (Red Seal,) gold	— 8 a — 8¼
Zinc, white French, in oil gold	— 10 a — 10½

VARNISHES—PER GALLON.

American Wearing Body	3 50 a 4 00
Coach Body	2 35 a 3 50
do do	1 80 a 2 00
Furniture	1 25 a 2 50
Black Asphaltum	1 00 a 1 50
Brown Japan	1 00 a 1 20
Liquid Paint Dryer	1 35 a 1 75
Harness, (black)	3 00 a 4 50
Shellac, Spirits	3 00 a 3 50

CEMENT—PER BARREL.

Portland (imported)	2 75 a 3 50
Portland (American)	2 50 a 2 75
Roman	2 75 a 3 25
Keene's, coarse	6 50 a 7 00
" fine	10 50 a — —
Martin's, coarse	6 00 a — —
" fine	10 50 a — —
Rosendale	1 00 a — —

DEADENING AND ROOFING MATERIAL.

Mineral Wool for Roofs and Deadening, per lb. — 1¼ a — 1½

HAIR.

Cattle, per bushel of 7 lbs	— 9 a — 12½
Goat, " "	— 15 a — —

SLATE.

Purple roofing slate, per square	$6 00 a 7 00
Green slate	6 00 a 7 00
Red slate	10 00 a 11 00
Black slate, Pennsylvania, (at Jersey City)	5 00 a 5 25
" Cargo rate	3 25 a 3 75
Slate tiles, 1¼-inch, rubbed, per square foot	20 a — 25

PLASTER PARIS.

Duty.—20 per cent ad. val. on calcined; lump free.

Nova Scotia, white, per ton	2 80 a 3 00
Nova Scotia, blue	2 75 a 2 85
Calcined, Eastern and city, per bbl	1 00 a 1 15
Calcined, city casting	1 20 a 1 25
Calcined, city superfine	1 30 a 1 50

LIME—PER BARREL

State, common	— 60 a — —
" finishing	— 80 a — —
Rockland, common, cargo rate	— 55 a — —
" finishing	— 75 a — 80
Ground	— 60 a — 65

Add 25 cents to above figures for yard rates.

FOREIGN WOODS.

MAHOGANY.

St. Domingo, crotches, ordinary to good, per ft	— 15 a — 20
St. Domingo, crotches, fine	— 20 a — 30
St. Domingo, logs, small	— 5 a — 8
St. Domingo, logs, large	— 20 a — 30
Frontera, Mexican, large	— 11½ a — 16
Frontera, Mexican, small	— 8 a — 10
Other Mexican	— 8 a — 14
Honduras	— 10 a — 15

ROSEWOOD.

Rio Janeiro, ordinary to good, per lb	— 2½ a — 8
Rio Janeiro, good to fine	— 5 a — 8
Bahia, ordinary to good	— 2 a — 6½
Bahia, good to fine	— 4½ a — 8
Honduras, per ton	10 00 a 20 00
Satin Wood, per foot	— 15 a — 60
Tulipwood, per lb	— 6 a — 12½
Lignumvitæ, small, per ton	10 00 a 20 00
Lignumvitæ, large	25 00 a 50 00

CEDAR.

Cuba, per superficial foot	— 12½ a — 16½
Mexican, small	— 8 a — 10
Mexican, large	— 10 a — 16
Florida	— 50 a 2 00

DOORS, WINDOWS, AND BLINDS.

DOORS, RAISED PANELS, TWO SIDES.

2.0 x 6.0	1¼ inch.	$ 67	—
2.6 x 6.6	1¼	— 95	—
2.6 x 6.8	1¼	— 99	—
2.8 x 6.8	1¼	1 04	—

DOORS, MOLDED.

Size.	1¼ inches.	1½ inches.	1¾ inches.
2.0 x 6.0	$1 23	—	—
2.6 x 6.6	1 52	1 93	—
2.6 x 6.8	1 57	1 85	—
2.6 x 6.10	1 59	2 01	—
2.6 x 7.0	1 62	2 09	—
2.8 x 6.8	1 62	2 09	2 57
2.8 x 7.0	1 69	3 17	2 69
2.10 x 6.10	1 79	2 26	2 84
3.0 x 7.0	1 87	2 45	3 00

INSIDE BLINDS.

Per lineal foot, 4 folds, pine	04 a — —
Per lineal foot, 4 folds, ash or chestnut	— 07 a — —
Per lineal foot, 4 folds, cherry or butternut	— 08 a — —
Per lineal foot, 4 folds, black walnut	— 10 a — —

DRAIN AND SEWER PIPE.

(Delivered on board at New York.)

PIPE, per running foot.

2 inches diameter,	$0 13	10 inches diameter,	$0 70
3 "	0 16	12 "	0 80
4 "	0 20	15 "	1 25
5 "	0 25	18 "	1 60
6 "	0 30	20 "	2 00
7 "	0 35	22 "	2 50
8 "	0 45	24 "	3 00
9 "	0 55		

REVIEW OF THE MARKETS.—An examination of the building markets reveals a very bright condition of trade. Consumption has increased to a considerable extent during the past month, and prices have stiffened on almost all descriptions of material. Dealers on all hands appear encouraged by this more favorable state of the markets, and are anticipating a still further improvement as the season advances—an anticipation that seems likely to be fulfilled in view of the large number of buildings contemplated for immediate erection in various portions of the city, and notably uptown, where rapid transit has so greatly stimulated building.

THE MARKETS IN DETAIL.—In the lumber market the past month the tone has been cheerful, and dealers generally have spoken more hopefully than for some time past. The quantity of lumber sold this season has been larger than the indications would have led the average observer to believe, the slow and careful form of business giving an appearance of greater dullness than actually prevailed. Prices have stiffened, and there has been left some margin for profit, with no reason to suppose that shading and concessions, except of a temporary character, will have to be resorted to in order to place merchantable and attractive grades. Accumulations have been reduced, fresh arrivals have been backward in many cases, and the promises for both consumption and shipment are first rate. In short, we find a very common belief that the general lumber market has seen its worst, and that a gradual tendency toward a more healthy position may be expected.

In the brick market common hards have retained a good, healthy market, and the general report has been of a most cheerful character. Demand has been active enough to exhaust arrivals as fast as they came to hand, and in some cases has exceeded the supply. The distribution has been almost entirely local, and in all cases went directly into consumption, no accumulation taking place in the hands of either dealers or contractors.

In the lime market trade has remained in about the same condition as reported in our last. The arrivals have been comparatively moderate, but this has been counterbalanced by a light demand, and sellers have been compelled to keep terms easy.

In the lath market demand has been quite active, and there has been a considerable amount of stock consumed, with prospects of still greater consumption during the present month.

In the hardware market trade has been dull. Builders' supplies are stated to be the most salable of any style of hardware, and the prospects are considered good for the summer, especially on local account. Prices have been steady, and not subject to any change on standard goods.

In the paint market there has not been much doing, and the market generally has had a dull tone.

In the metal markets Scotch pig iron has remained steady in price, and has been offered with much care. American pig iron has been slow of sale, but not unusually so for the season, and there is hope of an early increase of orders. Manufactured iron has met with a moderately active demand. Domestic pig lead has been unusually active, and prices have been higher and more firmly sustained. Tin in pig has been held with much firmness and apparent confidence, with demand not very active. Tin plates have been steadily held, and advices from abroad have been of a stimulating character.

Twist Drills.

Those not familiar with twist drills from practical experience have no idea of their merits, which are so great that we feel inclined to call them a blessing to the mechanic. They cut better than any other drill, require no forging and tempering by an experienced hand, before grinding them, as is the case with the old style drills; they are simply ground, and keep the cutting edge until entirely used up for their whole length. Especially for small drills this is very desirable, as in case of breakage, which may easily happen, all that is necessary is to grind the stump in the right shape and they cut as well as before, affording a great saving of time.

For the wood-worker they possess invaluable qualities, so great in fact that no carpenter who has become aware of this will do without them; indeed, we expect that in course of time, when their qualities become better known, they will entirely supersede all forms of other drills, at least for working the harder kinds of wood. The smaller kinds are of especial value to the cabinet-maker, for two reasons; first, they will never split the wood, as they cut only at the bottom of the hole, making it at once the right size, and thus causing no outward strain; in the second place, they are always made of such a good quality of steel that they will cut iron, consequently when they come in contact with a nail, metallic screw, or hard knot in a board, they will simply bore through without being ruined, as is often the case with ordinary bits, which require great care in this respect. With a twist drill the wood-worker can bore straight on without regard to such trifles; the only thing he will perceive is, that when he hits a nail, the drill will penetrate slower, a retardation is the only consequence, and perhaps a little deviation from the true direction if the nail is hit at one side; but even this can, if necessary, be avoided by the exercise of a little care.

We call special attention to these qualities, which, we believe, as yet have not been forcibly enough brought to the attention of all interested. For our part, since we became the fortunate possessors of a set of twist drills, we have hardly ever used any other kind, either for metal or wood, either on the lathe or by hand boring. We are satisfied that it is only the high price of the twist drills that has kept worthless cheap drills in the market, but every mechanic who indulges in the seeming extravagance of buying a complete set of twist drills, will agree with us that they are the cheapest in the end on account of their rapid and correct work and lasting qualities. A twist drill will outlast scores of other drills.

So much for the value of twist drills for mechanics; now a few words in regard to the manner of their manufacture.

We always supposed, and we are not sure but most mechanics thought so too, that twist drills were made by twisting a rod of red hot steel. They look as if they were made in this way, and their name implies it also. It appears that the first drills introduced in the trade were made in this way, but from some deficiencies in the machinery it was found difficult to make the twists regular and the groove of the right shape, so that in a short time a more perfect method was invented to secure better workmanship, namely, to cut the spiral groove on a lathe by means of an automatic sliding rest. In this way a true spiral groove of the desired shape was easily obtained, and thousands of such twist drills have been introduced and universally used. But good as they are, their method of manufacture involves a few peculiarities which are not to their advantage, and in which the forged twist drills were superior.

In the first place, the fiber, which in any drawn steel rod, always runs longitudinally, and is not only preserved but strengthened by forging and twisting, is cut across when grooving the spiral by a cutting instrument. Any one who doubts whether this amounts to much, has only to examine the fractures of broken steel rods of which the fibers have been separated by extension strain or torsion, by means of an apparatus for testing the strength of materials, such as that invented by Prof. Thurston, of Hoboken, N. J.

But the most important point is this: By forging, the outer surface is made extra dense and hard by the blows of the hammer, die, or other forging tool, and it is important to use this hardest surface for the cutting edge of any cutting instrument, knowing that mechanics are careful not to grind it away if the shape of the tool allows its preservation. In the customary way of making twist drills at present this dense, hard surface is cut away at the very place where it is needed, and the cutting edges at the end of the drill, instead of being the exterior hard skin, consist of interior material, where the steel is less dense and hard, so that a drill made after the primitive style, even when imperfect in other respects, will cut better and last longer than one made by cutting a groove. It is especially when the drill grows shorter by wear that this quality becomes very obvious, as in the forged twist drill this dense and hard upper skin, which lies in the groove, endures to the very last, as it cannot be ground away. This hard surface of the groove is also a protective feature against the splitting off of the lips, to which ordinary drills are so much subject, and which at once renders a large portion useless, which has then to be ground off—another reason why a forged drill must last considerably longer than one in which the grooves have been cut or filed.

We are pleased to state that the New York Twist Drill Co., of 240 Plymouth street, Brooklyn, N. Y., have returned to first principles and make their twist drills in the true original way, by forging and actual twisting, having, by new and improved machinery, succeeded in making a twist as true and of such a shape as to fully satisfy the requirements. It is accomplished by forging two straight grooves, one on each side of the bar, by means of dies of the proper shape; the bar is then re-heated and placed in a peculiar apparatus, which it would be difficult to describe without an engraving. This apparatus twists every part of the bar its whole length to a certain angle, so as to make a regular spiral twist of any desired pitch. It is evident that this method secures a more uniform depth of the groove, which it is impossible to obtain by cutting, scraping or filing, and that this uniformity secures the freeing of the drill from the bored out material, which, with an imperfect drill, often causes much delay and trouble. But the most important point is, as mentioned above, that this groove, not being made by any cutting tool, possesses the original dense and hard forged skin, and as it runs along the whole length of the drill, it will always be at the right place—the cutting edge—however much the drill may have become shorter by wear or partial fracture.

Home Department.

"Facts of Value to the Housewife."

Under the above title a series of recipes is going the rounds of the papers, very few of which contain anything new, most of them being familiar to every housewife; but what is very objectionable, some give injurious advice. For instance, it is said that "blue ointment and kerosene, mixed and applied to bedsteads, is an unfailing bed-bug remedy." Now this is dangerous advice; blue ointment contains mercury in the metallic condition, the most dangerous form to have in a bedroom; its gradual evaporation will produce mercurial poisoning, such as thermometer and mirror makers suffer from who are daily exposed to the emanations of metallic mercury.

That "kerosene oil will soften boots or shoes which have been hardened by water, and render them as pliable as new." It should here be added that it will cause the leather to shrink and soon deteriorate. Castor oil should be recommended instead of kerosene.

That "clear boiling water will remove tea stains, and many fruit stains;" that "kerosene will remove stains from varnished furniture;" that "cold rain water and soap will remove grease from washable fabrics." What housewife does not know all this?

Warning for the Peach Season.

A fatal case of poisoning has occurred in Paris which may serve as a warning to those families in which children are allowed to look after themselves for hours together. It may be assumed that very few children under the age, say, of ten or twelve have any idea that peach-stones or peach-blossoms are dangerous. They have been shown the deadly nightshade, and probably the wild hemlock, and have a great dread of them; but nursemaids are not nearly so fond of pointing out the peach tree as an object of horror and aversion. The victim of the recent accident in Paris had certainly not been cautioned against the attractions of the peach. He had developed, at the tender age of five and a half, the faculty of reasoning on inductive principles, and he saw no reason to doubt that as cherry and apricot stones contained eatable kernels the nobler fruit had at least an equally desirable treasure in its inmost recesses. Accordingly he secreted the stones of a number of peaches which had been sent to his mother from the country, and, possessing himself of a hammer, when left alone, broke them open and set to work upon a solid feast, to which he did hasty but complete justice. The taste of the kernels was not perhaps on a par with the expectations previously entertained, but it would be ridiculous to go through the severe labor of cracking such hard shells without entering into the fruition of the labor when once finished. So the unlucky child was found by his parent on her return writhing in grevious agonies produced by prussic or hydrocyanic acid. The arrival and efforts of the doctor were vain, and another item had to be added to the long list of "deaths by imprudence." It is as well, now that the fruit season has arrived, to explain to what extent poisoning properties are possessed by the peach-stone. The writers on toxicology state that an ounce of the kernels contain about one grain of pure hydrocyanic acid, and it is known that one grain of the poison will almost to a certainty kill any adult person. Two-thirds of a grain has often been fatal, and may be regarded as fatal for a child.

Dangers of Moving into Empty Houses.

A house while empty becomes a breeder of sickness. The reason is clear; disuse means the ordinary precautions for cleanliness, want of dusting and scrubbing, and often also of ventilation; the contents of cisterns, pipes, and drains become stagnant, while the air in the rooms becomes impure, all of which is favorable to the processes of putrefaction and the development of the germs of diphtheria, typhoid fever, and other zymotic diseases.

Parties moving from the city to the country, or from the country to the city, should remember this, and take care to have a thorough cleaning and airing performed before moving into a house that has been unoccupied for a season. Above all, clean out all rubbish from cellars and closets. Among the disinfectants to be recommended, if their use is deemed advisable, carbolic acid is among the best.

Glanders.—Of the diseases incident to humanity, none is more appalling than glanders. A dreadful case occurred in London recently. A physician reported that he saw the young girl in the hospital; a portion of her head was eaten away and the bone exposed in two places. The magistrate who examined the case said that he knew an engineer who died from glanders in three days, in consequence of the horse attached to a cab in which he was riding throwing off some matter, which fell upon him. Twenty years ago a lady of high rank in Paris was caressing her beautiful carriage horses; she had a tiny wound on her hand, and a little glandered matter from the nostril of one of the horses got upon it, from which she died in dreadful convulsions. It is always much better to put a piece of plaster over broken skin, however small.

Shall our Houses be Painted or Plastered?

Of course, says the *American Builder*, everybody knows, or ought to know, that walls and ceilings are finished with plaster. But everybody may not be aware that plaster has the property of absorbing moisture. This, perhaps, will not take place in rooms where a fire is kept steadily; but in rooms left, as is often the case, for weeks without a fire, the walls will take up a considerable quantity of damp. The effect will be injurious to the health of the inmates. There are few persons who have not suffered from a mysterious cold, caught they know not how, though, perhaps, damp in the plaster had something to do with it.

The extent to which damp is absorbed in a plastered wall may be discovered by noticing what so often takes place in the rooms where the walls are painted and have become chilled by a season of cold weather. As soon as the temperature becomes warmer the atmosphere is condensed on the walls, and at times in such quantities as to run off in streams. Now, had it not been for the paint, the greater portion of this moisture would have been absorbed by the plastered walls. And as a consequence the quality of the plaster would have been impaired and the room made unwholesome. In view of this defect in plastered walls, it becomes a question well worth considering, whether, in finishing a house, the walls should be papered or painted. If paint is decided on, it is highly necessary that the painting be properly done and good materials employed. White lead, which is the chief ingredient of all paint used is of late years heavily adulterated—a reason why some painters can do work so much cheaper than others. There are also dishonest painters who will lay on nothing but "whiting" and size for the first coat, and finish off with one coat of oil paint. It is not easy to detect the fraud at the time, but as such paint soon wears off the wall, and attaches itself to the garments of those who rub against it, the customer speedily finds out that he has been cheated. It takes three or four coats of good oil paint honestly laid on to make good work of painting plastered walls.

In painting walls there is ample scope for taste, and such colors may be chosen as are most suitable for each apartment, and in harmony with the furniture. Apartments lighted from the south and west, particularly in a summer residence, should be cool in their coloring; but the apartments of a town house ought all to approach toward a warm tone. In a drawing room the coloring should be characterized by vivacity, gayety, and light cheerfulness; by light tints of brilliant colors with a considerable degree of contrast and gilding—the walls being kept in due subordination to the furniture, though partaking of the general liveliness. The characteristic coloring of dining rooms should be warm, rich and substantial, without vivid contrasts, and gilding should be avoided, unless in small quantities for the sake of relief. Parlors ought to be in a medium style, between that of drawing room and dining room. Libraries should be solemn, grave and quiet in color and finish, while bedchambers should be light, cleanly and exceedingly cheerful. A greater degree of contrast between the room and its furniture may be admitted in the chamber than in any other apartment. Stairways, halls and vestibules should be of a cool tone and simple in their style of coloring, being in that what they are in utility—a link between the exterior simplicity of a house and its interior richness and comfort.

Famine in Russia.—A famine next year in Russia is predicted by Russian journals. Last year about one-third of the crop was destroyed by beetles and marmots, so that the seed has been deficient; and the cattle plague took off about ninety per cent of the cattle in many places. To these misfortunes must be added the extraordinary drought of the past half year. Then in Russia there are too many holidays, (about one hundred in the year); drunkenness also is a widespread vice, whose wastefulness is greatly felt. Most of the land in Russia is under mortgage to bankers, the proprietors are hardly able to pay their interest, and the arrears are everywhere about twenty per cent. The grain, which is the chief article of export, and which furnishes taxes and supplies, is devoured by parasites while growing, after being gathered, and on railroads.

Important to Sawyers.

We call the attention of all interested to the Sawyer's Hand-Book, which is mailed free to all who send their address to Messrs. Emerson, Smith & Co., Beaver Falls, Pa. It conveys a great deal of important and valuable information, written by this firm, who have earned a great reputation in the improvement and manufacture of saws of various kinds. We also call attention to their advertisement, to be found in our advertising pages, in which will be found a list of the saws manufactured by them, which are described, with their proper uses, in the book.

Miscellaneous and Advertising.

"Wood-Working Machinery vs. Stover." See pages 150 and 151 of this number.

New Patent Paper Boxes as applied to all wrapping purposes. Send for sample, stating size, to Wm. Meschenmoser, 120 William street, New York.

The Lyman Mills at Holyoke, Mass., are introducing electric apparatus for the lighting of their thirty-two picker-rooms burners. The danger arising from the carrying of lights about will be entirely avoided.

We take pleasure in stating that Messrs. Clark & Co., of 162 West 27th street, this city, the well-known manufacturers of self-coiling revolving steel and wood shutters, received the silver medal at the Paris Exposition.

If you want new or second-hand machinery of any description, address the George Place Machinery Agency, 121 Chambers and 103 Reade streets, New York.

A Chance for Inventors.—The South Australian government has offered a reward of $20,000 to the inventor of the best machine combining within itself the various operations at the same time of reaping and cleaning, fit for bagging on the field, the various cereal crops of South Australia.

Mr. Richard Pancoast, for several years the New York manager of the well-known Philadelphia house of Morris, Tasker & Co., has formed a co-partnership with Mr. H. G. H. Tarr, for the transaction of business in pig and manufactured iron. The new firm, in addition to a general commission business in iron and piping, have been appointed agents for the Reading Iron Works. The office of Messrs. Pancoast & Tarr is at 28 Platt street, New York.

To Users of Steam.—Hundreds have been deceived by worthless compounds sold by unscrupulous parties for Asbestos Steam Pipe and Boiler Coverings, which have proven unsatisfactory, and have cost from 50 to 100 per cent more than the genuine, which are the most effective and economical non-conductors in the world, and are manufactured only by the H. W. Johns Manufacturing Company, 87 Maiden Lane, New York. Be sure and note the address, and send for samples, prices, and estimates of cost of applying, before making contracts.

The public are indebted to the J. L. Mott Iron Works for placing in the market two valuable sanitary arrangements; first, Demarest's patent water-closets and slop or urinal safes, which are pronounced by those who have used them to be unsurpassed by any other closet made. They effectually exclude all sewer gas. The other sanitary arrangement which we allude to is Mott's latrine for use in railroad depots, hotels, hospitals, asylums, factories, and other such buildings. The value of this contrivance cannot be over-estimated, and parties fitting up buildings would do well to write or call on the Mott Iron Works, at 88 and 90 Beekman street, New York, and get estimates of cost. They will find these latrines to be inexpensive, and free from any of the defects and drawbacks of other arrangements of this character.

We have just received a circular from the Woonsocket Rubber Co., containing the following testimonial from the general manager of the "B" line of steamers, regarding the value of the Usudurian Packing made by this company:

Office of "B" Line, No. 58 West Street,
New York, May 15th, 1879.

Woonsocket Rubber Co., 80 and 82 Reade St., New York City:

Gents: We have had your Usudurian Packing in constant use on steamers "S. E. Babcock," "W. E. Cheney," and "John Fuller," covering a space of three years, and have not had a single failure in any way whatever. We have had no occasion to renew even one joint in that time, and joints that were never tight previous to using Usudurian, are now perfectly tight. Our boiler gaskets (hand-hole and man-hole) are as good as when first applied. We know of the same results in a number of other places, and we are satisfied that any one having leaky joints will find that after using Usudurian, it is fully up to the standard claimed for it—namely, reliability, durability, and economy.

Yours respectfully, Capt. Edward Barrett,
Chas. F. Barrett. *General Manager.*

The circular referred to also contains a list of over fifty steamship owners and manufacturing firms who are using this packing, all of which speaks well for this valuable substance.

Design for Suburban House.

The house on the opposite page was designed by Messrs. Clarence W. Smith and Augustus Howe, Jr., of 7 Warren street, New York, for H. Van W. Myer, of Newark, N. J., and is one of a number of small houses to be built for Mr. Myer in Newark.

It is to stand on an ordinary 25-foot front city lot, and in order that access to the rear of the house may be obtained from the outside, the house has been made 20 feet wide, its depth being 32 feet, with an extension 14 × 15½ feet.

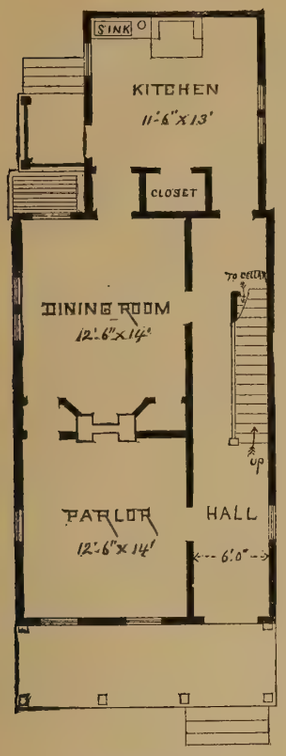
The interior arrangement is most admirable; on the first floor there is a parlor, 12 feet 6 inches by 14 feet; a dining-room, 12 feet 6 inches by 14 feet; a kitchen, 11 feet 6 inches by 13 feet, while a hallway 6 feet wide extends from the front door to the kitchen. In the latter room there is a good sized closet. On the second floor there are two bedrooms, one in the form of an L, measuring 19 feet in its widest part, and 12 feet 6 inches where narrowest, by 13 feet; and the other 11 feet 9 inches by 12 feet 6 inches. Both rooms are provided with closets, while there is also a closet at the end of the hall on this floor. In the attic story there are two bedrooms.

The hights of the first and second stories are respectively 9 feet 6 inches and 9 feet. The house is balloon framed, of best quality dry hemlock, and is covered with 6-inch clapboards, showing 4½ inches to the weather. The water-table and corner boards are of pine, as are also the bands and cut-work across the front of the building. The roofing everywhere is to be of shingles, sufficient pitch being given to the piazza and extension roofs to admit of this.

Inside the house the doors, flooring, etc., will be of pine; the front stairs furnished with black walnut hand-rail, balusters, and newel. A marble mantel will be set in the parlor, while that in the dining-room will be of wood. The kitchen is to have a range, with water-back, boiler, etc., complete.

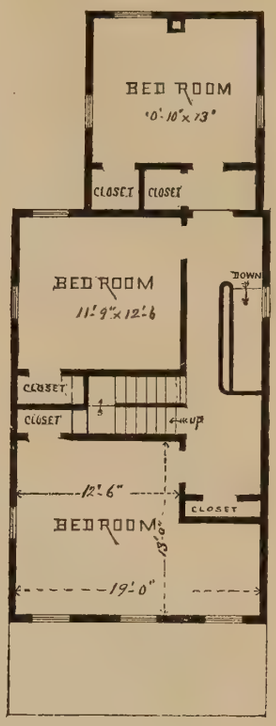
To the painting of the outside of the house, the blinds, shingles, etc., special attention is to be paid, in order that by a happy arrangement of color additional effect will be given to the general pleasing appearance of the house. And here, by the way, is something that may well claim the attention of architects and all interested in house building, the picturesqueness of a design being marred, if not utterly destroyed, by indifference to this matter of color.

The house is estimated to cost about $1,500.

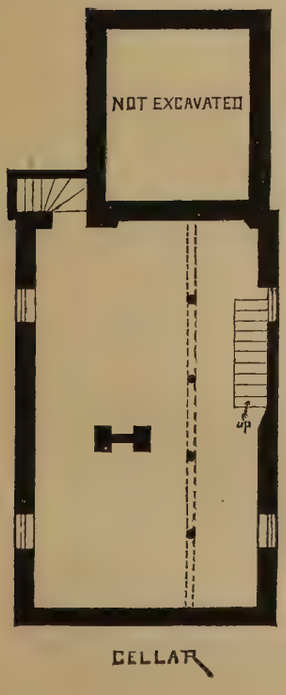


FIRST STORY

FRONT ELEVATION

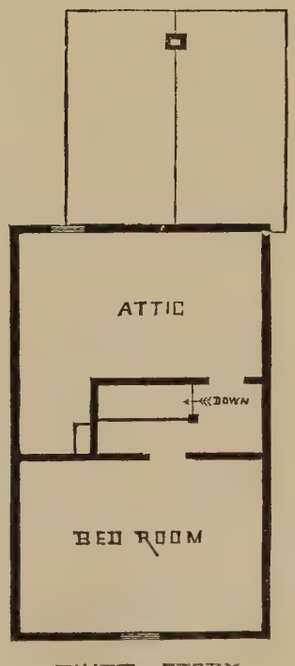


SECOND STORY



CELLAR

Scale—⅛ Inch to the Foot.



THIRD STORY

DESIGN FOR SUBURBAN HOUSE, COSTING $1,500.

Color Blindness.

The absolute proof that the perception of color is subjective and not objective, is found in the fact that a certain percentage of mankind is color blind—that is, cannot distinguish between certain colors, which commonly are red and green. It is very strange that this color blindness is most always confined to these two colors, which are so different that each is, as it were, exactly the opposite to the other; for this reason they are called complementary colors. In order to make it clear which are complementary colors, it is simplest to arrange the prismatic (rainbow) colors in a circle, thus:

Violet blue.

Blue. Violet.

Blue green. Reddish violet.

Green. ⊙ Red.

Greenish yellow. Orange red.

Yellow. Orange.

Orange yellow.

If we draw diagonals or diameters through the center of the circular space around which the names of the colors are arranged, the two complementary colors will be found at the extremity of each diameter.

As stated above, the most common cases of color blindness exist in an inability to distinguish green from red; and this is not so unusual as is ordinarily supposed. Out of about every 30 boys there will be one who cannot distinguish ripe red cherries among the green leaves, while the other 29 easily distinguish them by their contrast of color; to the color blind boy the leaves and cherries will appear green, or perhaps red. He cannot see the cherries at all until he comes so near that he can distinguish them from the leaves by their round shape. This experience will surprise him perhaps, but he never comprehends why the other boys so readily see what he cannot so soon distinguish. We remember a young man in whom color blindness had never been observed until he was so far advanced in the drawing class as to paint in colors, when it was soon observed how curiously he would paint patches of red through the trees of a landscape. He could not distinguish the red from the green on his palette, and so used these colors indiscriminately when painting green foliage.

The experience of recent times has taught a great deal upon this subject, as it has not only attracted the attention of theoretical physiologists, but of practical railroad managers, who conceived the danger of employing signal men and engineers who could not distinguish a red from a green signal light. It is evidently as impossible to explain to a color blind person the difference between red and green as to explain to a person born blind the difference between any colors at all—neither can conceive a thing which is entirely a subjective impression, beyond the scope of descriptive language.

Recently a book has been published on this subject, written by Dr. B. J. Jeffries, from the press of Houghton, Osgood & Co., of Boston, which is a complete summary of the facts and theories upon the subject, and pointing out its dangers and remedies. We wish it in the hands of our railroad managers, who, on some subjects, are singularly behind those of other countries, in this matter. In Europe railroad employees are examined in this respect; of course the color blind employee, if he knows his own defect, does not confess it if he is in a position where this fact might deprive him of his occupation, and the problem in his case is to find him out. This is done by a system of traps founded on color. The employee is given a number of pieces of colored cloth or worsted and required to match them, and the color blind individual usually falls into the trap by putting red with green.

It is high time for our railroad companies to give this subject their earnest attention.

Note.—After the above is in type we learn that Dr. Keyser, of Philadelphia, has examined the train hands of the Philadelphia railways, and finds that 3½ per cent are color blind, or 1 in every 29 cannot distinguish red from green. In addition to this, there is 8½ per cent, or 1 in every 12, who can distinguish these colors, but not shades of the same colors; so that 12 per cent, or 1 in every 8, are deficient in that perception of color which is absolutely necessary on railroads where colored lights are used as signals.

Another invention has been the result, namely, an arrangement of lights by placing lanterns in horizontal or vertical lines, or placing three of them at the angles of a triangle. In this way various signals may be made and understood, independent of any color of the light.

ARTIFICIAL VANILLA.—A substance having the flavor of vanilla can be obtained from oats, in case the oat cakes obtained as an incidental product by pressing the interior out of oats, are treated in the same way as is done to obtain the glucose from the flowers of the chicory plant. This almost absolutely odorless substance changes when its watery solution is submitted to oxidation, into a substance possessing an odor like vanilla, from which the essential oil can be extracted with ether, and further purified.

New Publications.

Practical Instruction in Animal Magnetism. By J. P. F. Deleuze. New York: S. R. Wells & Co.

This work, which has been translated from the French, was first published in 1843, and is now re-published with an appendix containing cases in the United States. The publishers, in a preface, express the opinion that in view of the fatal accidents resulting from the application of anæsthetics, it would be desirable to return to the older method of performing important and protracted surgical operations, and while the same are going on to keep the patient under magnetic influence. In this way it is claimed the patient does not obtain the slightest knowledge of pain or suffer the least evil effects; and this is one of the reasons given which induced the re-publication of this book.

In regard to the book itself, a few facts are very striking to the impartial reader. The author, in his introduction, begins as follows: "Several persons have requested me to publish, upon the subject of magnetism, plain and simple instructions, free from all theory, and proper in all cases to direct those who are convinced of the reality of the agent, and who are at a loss how to make use of it, I am now going to fulfill this task, solely with the view of being useful."

Now, let us see if the author confines himself to "plain and simple instructions, free from all theory." In the beginning of Chapter I., he says: "Man has the faculty of exerting over his fellow men a salutary influence, in directing toward them, by his will, the vital principle. The name of Magnetism has been given to this faculty. . . . A substance emanates from him who magnetizes, and is conveyed to the person magnetized in the direction given it by the will. This substance, which sustains life in us, we call the magnetic fluid."

Such expressions do not look like "plain and simple instructions, free from all theory." It is, indeed, the old mesmeric theory, which borrowed the conception of a magnetic fluid from the formerly accepted theory of mineral magnetism, which consisted in the hypothesis of an imponderable fluid as the cause of magnetic attraction, in the same way as electric fluid was accepted as the cause of electric phenomena, and a caloric fluid as the cause of all phenomena of heat. At the present day all these hypothetical fluids have been discarded; modern physics, enlightened by the doctrines of the correlation and conservation of forces, does not now recognize such fluids, but explains all phenomena by various modes of molecular motions, and any theory which at the present day clings to such fluids is chimerical. The author further says:

"The magnetic fluid may not only act directly upon the person whom we wish to magnetize, but it may also be conveyed to him by an intermediate body which we have charged with this fluid, to which we have given a determined direction. . . . The action of the magnetic fluid, being relative to the direction given to it, will be salutary only so far as it is accompanied with good intentions."

Repeatedly it is taught that a firm belief in the reality of the theory expressed, and confidence in its effectiveness, are absolutely requisite to success. In other words, it is confessed that a prejudice in favor of the theory is necessary, and that the neutrality of a doubter who simply searches for truth without prejudice either way, is conducive of negative results. A theory based on such premises can never carry conviction to a sound mind, and we dismiss the book with the remark that it is easy enough to tell all kinds of wonderful stories—the inherent credulity of mankind, combined with a natural inclination to the wonderful and incomprehensible which prevails in many minds, will cause many to believe all that is related in this book. Unfortunately, however, for the defenders of these magnetic or mesmeric theories, when the accounts of cases which offer the possibility for research, are subjected to a searching investigation, there is little of the wonderful left, and our reliance upon human testimony, even when supposed to be most honest and truthful, is most sadly shaken.

Graphical Computing Table. By William H. Bixby. New York: John Wiley & Sons.

We are indebted to Mr. Bixby for having introduced in our mathematical literature the highly ingenious and practically useful invention of M. La Lanne, the eminent French engineer and Inspector General of Bridges and Highways. The principle is based upon horizontal and vertical distances, which are the factors in the problems, while the diagonals are the results or answers of the problems. The table is a large lithograph on Bristol board, containing a square of 36 centimeters (about 14½ inches) sides, while the divisions at one corner are small, and increase in both directions, so that the squares formed by the parallels drawn become rectangular along the sides, but remain squares along the diagonal. The sides and diagonals are all numbered; to the table belongs a little book for explanations, which is very neatly printed on strong paper, as any work of this kind, subject to much handling while in use, always should be.

It is impossible to give our readers an idea of its use without having the table itself, so we must content ourselves with stating that by its help the following problems can be solved graphically: Multiplication and division—to find the 2d, 3d or 5th power of any number; also to extract the 2d, 3d or 5th root; to find the circumference and area of a circle and sphere; to find the geometrical lines, tangents, co-tangents, sines and cosines; and, finally, the reduction of meters into feet, and *vice versa*.

To the book of explanations is added an appendix with data, for reference in the use of the table. We recommend it to all those interested in the progress of practical mathematics. The price is only 75 cents.

Spon's Encyclopædia of the Industrial Arts, Manufactures, and Commercial Products. London and New York: E. & F. N. Spon.

We have received one of the parts of this work, which promises to be a valuable addition to the literature of the subjects which it will embrace. It is to be published in about thirty monthly parts, and each number, like the one before us, is to be copiously illustrated. All the important articles will be written by manufacturers or producers, or by men familiar with the processes of manufacture and the details of production; the object of this arrangement being to give accurately and fully the processes actually in use on the large rather than on the laboratory scale, and the details of the methods adopted in commercial practice. This publication will be a valuable work of reference, as it will give in a readily accessible form general and technical information not elsewhere obtainable.

Table of the Principal Speeds Occurring in Mechanical Engineering, in Meters per Second. By P. Keerayeff, of St. Petersburg, Russia. Translated from the Russian by S. Kern, M.E., of St. Petersburg. London and New York: E. & F. N. Spon.

This book gives the proper speed of belts and ropes when used for various purposes; the proper speed of various cutting tools as used on different metals; speed of wood-working machinery, of pistons and pump plungers, of fly-wheels, of ships, steamers and locomotives, of flour and oil mills, of water, gas and steam, of animal powers, and lastly, of sound, light and electricity.

Ames' Alphabets. Adapted to the Use of Architects, Engravers, Engineers, Artists, Sign Painters, Draughtsmen, etc. Price $1.50. New York: Bicknell & Comstock.

This collection contains the usual alphabets—Roman, plain, shaded, and ornamental; old English, German, and Church text; Script, plain, and some very elaborately ornamented; Medieval, Gothic, and what we like best, letters especially adapted for sign painters, who we hope will take the hint and give us some new efforts in perspective. We also find in the book a sheet with topographical signs, which does not belong among the alphabets, and may have been put in by mistake.

PAMPHLETS RECEIVED.

"Register of the Lehigh University at South Bethlehem, Pa., for the Years 1878–1879."

We are indebted to the American Institute of Mining Engineers for the following papers: "The Wheeler Process for Welding Iron and Steel without the Use of Fluxes," by D. Torrey. "The Jenks Corundum Mine, Macon, N. C.," by R. W. Raymond, Ph.D. "The Mechanical Work Performed in Heating the Blast," by Prof. B. W. Frazier. "New Determinations of the Coefficients of Friction of Lubricated Journals, and on the Laws Governing such Friction," by R. H. Thurston, A.M., C.E.

"Address of Prof. R. H. Thurston, Vice-President, before the American Association for the Advancement of Science," at the St. Louis meeting, August, 1878. Salem: Printed at the Salem Press.

"A Few Considerations in Respect to Prison Labor."

"Report on Cold-Rolled Iron and Steel as Manufactured by Jones & Laughlin, American Iron Works, Pittsburgh," by R. H. Thurston, A.M., C.E. Pittsburgh: Printed by Stevenson, Foster & Co.

Notes and Queries.

This department is intended to furnish, for the benefit of all our readers, information on any subject of scientific or practical knowledge falling within the field of The Manufacturer and Builder. *All persons possessing additional or more correct information than that which we give relating to the questions, are cordially invited to communicate it to us for publication. We also request that all questions or answers be written on separate pieces of paper, and addressed to the Editor.*

QUESTIONS.

(2406) Depillatories.—Will you be kind enough to give me a recipe that will remove superfluous hair—something that will be safe but sure.—C. E. C., West Meriden, Conn.

(2407) Velocity of Water in Siphons.—Suppose water is drawn from two wells by siphons which are just alike in all respects, except that one well is say 12 feet deep and the other 24 feet. In other words, the highest point in the pipe above the water level in one case is 12 feet and in the other 24 feet. Will the one with the least rise discharge the most water? If it does, will the discharge increase in a regular ratio as the highest point in the pipe is lowered from the upper limit at which it will flow, down to the water level?—E. P. T., Youngstown, Ohio.

(2408) Hydro-Extractors Worked by Hand.—While in England, I saw in the public wash-houses a machine made on the same principle as the hydro-extractors used in dye-works, but worked by hand. They were made very light and cheap. By their use one woman could extract nearly all the water from a large quantity of washed clothes in a few minutes. Can you give me the address of a manufacturer of similar hand machines in this country?—J. M., Newton, Mass.

(2409) Harmless Hair Dye.—Can the harmless dye be put up and sold—that is, will it keep? Or must it be used as soon as the acid is put in?—E. N. W., Worcester, Mass.

(2410) Furniture Polish for Winter Use.—I have a solution of paraffin wax, mixed with turpentine and linseed oil, that I use for polishing furniture, etc. When the temperature is 60° Fah., it works very nicely, but as soon as the weather is lower than 60° Fah. it begins to congeal, and the colder the weather the thicker the solution becomes. Can you inform me of anything that I can mix with it that will prevent it from congealing, and at the same time not destroy its drying qualities?—W. H. B., Titusville, Pa.

(2411) Making Gilded and Black Letters on Marble.—Will you please inform me how to put gilding on scrolls or letters cut in marble; also how to put black on letters so that it will stand exposure to the weather and not stain the marble.—W. & P., Knightstown, Ind.

(2412) Belgian Anti-Friction Metal.—I hear that in Belgium an anti-friction metal has been invented, far superior to Babbet metal. Can you give the recipe?—O. B. L., Dixon, Ill.

(2413) Eccentric vs. Crank.—Which has the greatest power, with an equal force applied, a crank or an eccentric, the throw being equal? Is there any advantage of one over the other?—C. R. H., Bridgeport, Conn.

(2414) To Make a Crank with a Variable Throw.—What is the best way to arrange a crank so that I can vary the length of the stroke? I made a disk with holes at different distances from the center, into any of which holes I can insert the crank pin, but it does not give satisfaction.—C. R. H., Bridgeport, Conn.

(2415) Estimate of Water Power.—What should be the quantity and velocity of a current of water to produce 25 horse-power?—J. H. B., Ensley, Mich.

(2416) Difference in Level of the Atlantic and Pacific Oceans.—I read with much interest in your June number, the article on "Piercing the American Isthmus." Will you please inform me if the water on the Atlantic and Pacific sides of the Isthmus of Darien is on a level; if not, on which side is it the highest? how much? and what is the cause of the difference of level?—J. V. B., Yankton, Dak.

(2417) Expansion Joints in Steam Pipes.—Can expansion joints be used with success in a line of steam piping 120 feet long? I have a great deal of trouble in keeping my unions tight in steam pipes used for heating purposes.—A. L. G., Port Traverton, Pa.

(2418) Casting vs. Stamping.—In making Corinthian columns we find the ornaments very expensive. We have found no better way than to cast them separately and put them on a sheet-iron thimble and slip them over the top of the column. We notice on your frontispiece the representation of a capital by itself, which suggested the idea of writing you for information on the subject. We have tried galvanized iron stamped, but the cost is enormous. Can you give us any information?—F. J. M., Toledo, O.

(2419) Strain on a Piano by the Strings.—Can you tell what the strain is on pianos, as at present manufactured?—D. G. L., New York City.

(2420) Is Canned Food Dangerous.—From the extensive use of canned fruits and meats, it is an important question whether tin and lead, especially the latter, which is always present in the alloys used for tinning and soldering, may not be acted upon by the contents of the can and contaminate them with their poisonous compounds. If this matter has not been investigated, I take the liberty of calling your attention to it, with the request that you publish the results attained.—A Physician, New York City.

(2421) The Treatment of Imaginary Quantities.—On page 80 of "Olney's University Algebra," the examples under No. 3 read as follows: Show that $\sqrt{-2}\times\sqrt{-8}=4\sqrt{-1}$; also that $\sqrt{-256}\times\sqrt{-27}=48\sqrt{3}\sqrt{-1}$; also that $\sqrt{-2}\times4\sqrt{-3}=4\sqrt{6}\sqrt{-1}$. Every way I have worked these I get the following answers: -4; $-48\sqrt{3}$; and $-4\sqrt{6}$. I say the examples cannot be proved as given in the book.—M. S. H., Knightville, Me.

(2422) Making Pure Vegetable Acids.—While lemons are so abundant and cheap, the idea is suggested to me whether it would not pay to make pure citric acid from them. I would like to have your opinion in regard to it. What is the method of doing this?—F. G., New York City.

(2423) Making Ethereal Oils.—How can I make oil of lemon or orange? Would it pay to do this?—F. G., New York City.

(2424) Motion on Rough and Smooth Inclines.—I have had a controversy with a friend, who holds that it is easier for a team to draw a load up a moderate incline when the road is rough than when it is smooth. I hold that a smooth road is always easier, under all circumstances. Who is right?—S. L., Brownsville, O.

(2425) Single and Double Cream.—What is the difference between what is called single and double cream?—A. S., Brooklyn, N. Y.

(2426) Electric Telegraphs in Russia.—To what extent has the electric telegraph been introduced in Russia? Are there any statistics in regard to it? If so, will you please publish them.—G. M., Camden, N. J.

(2427) Coal Production of Belgium.—I understand that little Belgium produces an enormous amount of coal. Can you tell how much?—J. D., Delano, Pa.

(2428) Coal Production of China.—Is it true that the enormous coal fields in China will be worked to supply the demand of steamships plying on the Pacific Ocean and Indian Seas?—J. D., Delano, Pa.

REPLIES.

(204) To Drive Rats Away without Poison.—As an addition to the three methods given in reply to Query 204, on page 72 of our March number for 1872, we will state that Dr. T. C. Smith, of Salem, Mass., has invented a new method. After catching a rat alive, he pours carbolic acid over him and turns him loose. His sisters, cousins, and his aunts, as well as distant relatives and acquaintances, do not admire the fragrant odor, and conclude to leave for more agreeable quarters. Dr. Smith is a real genius and friend of humanity, and unborn generations will yet rise up and bless his memory. New York has a few rats and offers a fruitful field for testing the merits of the doctor's invention. Who will try it?

(2393) Undertakers' Books.—We are always thankful for additional items relating to the answers we give to questions, which answers, of course, only reach as far as our information on the subject extends. We are therefore pleased to be enabled to insert the following note which we have received from Mr. J. H. Symonds', an extensive publisher in Boston, Mass.: "The answer to Query 2393, in your June number, attracted my attention, and I desire to set you right in this matter. A. H. Nirdlinger & Co., of Rochester, N. Y., publish a monthly exclusively in this interest, called *The Casket*. H. E. Taylor & Co., of New York city, publish one called *The Undertaker*. F. H. Hill & Co., of Chicago, Ill., issue another; and the *American Cabinet-Maker* publishes an undertaking department, weekly." That we, with so many others, were not aware of the existence of these publications, only proves that the publishers would do well to make them more widely known.

(2406) Depillatories.—We have several times given recipes for depillatories, but as it was a long time ago, and we have some additional information on the subject, we will again return to it: 1st. The constituents of the most common depillatories are 4 parts of quicklime and 1 of orpiment (tersulphid of arsenic), mixed with water to a paste; but this is dangerous, especially when there is an abrasion of the skin where the arsenic might be absorbed in poisonous quantity. 2d. It is safer to employ a strong solution of sulphid of barium mixed into a paste with powdered starch, used immediately after being mixed, and allowed to remain only 5 or 10 minutes. 3d. *Martin's Depillatory.*—Two parts of sulphid of calcium mixed with one part of sulphur; apply a light coating, leave it on for 10 minutes, then wash off. 4th. *Boudet's Depillatory.*—Hydrosulphid of sodium, 8 parts; finely powdered quicklime, 10 parts; starch, 11 parts; apply not longer than from 2 to 4 minutes. This is recommended as very effective and safe. 5th. *Chinese Depillatory.*—Quicklime, 8 parts; dry pearl-ash, 1 part; sulphid of potassium, 1 part. Used in the same way as No. 4. 6th. Another prescription is that mentioned under No. 1, with the addition of starch and warm water, or soap lye. 7th. Also that mentioned under No. 5, mixed with starch and warm water, and applied to the parts after having first been shaved. *General Remarks.*—In preparing the paste, no iron knife, but a wooden or bone one should be used. A good way is to make the paste rather thick, spread it on a piece of linen or strong paper, and apply like a plaster. Leave it on from 5 to 15 minutes, or less if pain begins; then take it off, wash with warm water, and apply cold cream or a simple ointment if necessary. Most of the ingredients prescribed lose their property if not kept in well stoppered bottles. No mixing or liquid should be added to the dry substances except immediately before use. Apply to a small surface at a time, and use great care to prevent extension of the substances to parts where it is not needed. Also be careful not to leave it on longer than necessary, as a too prolonged action may injure the skin.

(2407) Velocity of Water in Siphons.—The velocity of water in a siphon does not depend upon the depth of a well, or the length of the siphon under water, but on its hight and the difference between the hight of the water in the well and the lower opening of the siphon from which the water discharges. If there were no friction or inertia, this velocity would always be equal to that obtained by a body falling freely through that hight. For instance, let the discharging opening of the siphon be 15 feet below the surface of the water in the well, then the water flowing out would have a velocity of 30 feet per second; but it is always considerably less by reason of the inertia and friction of the water against the tube. The amount of this retardation is difficult to determine exactly, as it depends upon the width of the tube, the smoothness of its interior surface, its more or less sharp bends, and the hight of the siphon. Thus, a siphon that discharges the water 15 feet below its surface, will discharge most and be nearest to the above statement when it is very wide and very smooth interiorly, when the bend is like the arc of a large circle, and also when the bend does not rise much above the surface of the water. On the contrary, the velocity named is more or less retarded by the pipe being more or less narrow or rough, bent at sharp angles, and by having to raise the water to a greater or lesser hight before the descent begins. Applying the above principles, you will see that the answers to your questions must be in the affirmative.

(2408) Hydro-Extractors Worked by Hand.—The use of steam power is so common in this country that here, even in public wash-houses, the hydro-extractors are worked by steam power transmitted by a belt. If in England they are still often worked by hand, it is simply for the reason that England is behind the age in many respects. The English do not yet fully appreciate the use of belting for transmitting power. For the effective driving of such machines belting is far better than gearing. We think it disgraceful to use in a public wash-house a man, much more a woman, to apply brute force to such an extent as to drive a centrifugal hydro-extractor, when steam power is cheap, and easily obtained and transmitted. We believe and hope that such hand machines are not made in this country. If we are mistaken, we invite manufacturers to come forward and correct us.

(2409) Harmless Hair Dye.—We suppose you refer to the hair dye described in answer to Query 2304, on page 47 of our February number. If so, you will find your question disposed of in answer to Query 2361, on page 120 of our May number, in which we anticipated your inquiry by saying: "To the above we add: 5th. Do not dissolve the pyrogallic acid until just before you are going to use it, as when it is dissolved it slowly decomposes, even in the dark."

(2410) Furniture Polish for Winter Use.—There is nothing easier than to adapt these preparations for cold weather. You have only to diminish the amount of paraffin. It would be well to have two or three preparations of the same mixture, but containing different proportions of paraffin; one for summer use, congealing at 60°, working well when the temperature ranges from 60° to 80°; one for use in the spring and fall, congealing at 45°, and working best when the temperature is from 45° to 60°; and another with still less paraffin, congealing at 30°, to be used in cold winter weather, when the temperature ranges from 30° to 45°.

(2411) Making Gilded and Black Letters on Marble.—The best gold size for open-air work is made of a turpentine varnish, which is put on where gilding is required. When it has dried for some time, but is still sticky, the gold leaf is put on, in the same way as painters apply the gilding to sign-boards. There is another method, which is to rub the gold leaf with honey, so as to pulverize it; then to wash the honey out with water, dry the gold powder and mix with the varnish, applying it with a brush. A cheaper way is to mix bronze powder with the varnish and use it in the same way, but it does not give such lasting results as when genuine gold is used. Trinidad asphaltum, softened by heat, is the best to use to fill in for black letters. In order to make it stick well, the deep part of the cut letters should be somewhat rough, and if the stone is warmed it will hold better yet. You might also soften the asphaltum with some petroleum, but then there is danger of staining some kinds of porous marbles.

(2412) Belgian Anti-Friction Metal.—It consists of an alloy of copper with small quantities of tin, lead, and antimony. To make it, melt 1 part lead, 2 of antimony, and 16 of tin; when well fused and bright hot, add gradually 80 parts of pure copper, which will slowly dissolve in the melted alloy of the other metals.

(2413) Eccentric vs. Crank.—An eccentric is nothing but a crank pin, so much enlarged that the shaft lies inside its circumference; there is, therefore no difference whatever, except that the eccentric has a longer and larger surface exposed to friction, and that the rubbing surfaces move with more velocity over one another—all of which is in proportion to the relative diameters of crank pin and eccentric circle. By the use of a good lubricator the difference is scarcely perceptible. The advantage of an eccentric over a crank is that it can be applied to

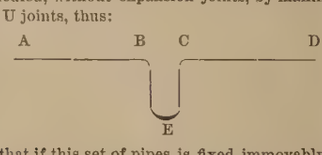
any part of a shaft, which cannot be done with a crank, the latter requiring the shaft to be cut. Eccentrics, however, are unfit for a large throw. Imagine, for instance, an eccentric equivalent to a crank 6 feet ong, giving a throw of 12 feet; it would require circles of at least 13 feet in diameter; hence eccentrics are only used when the throw is small.

(2414) To Make a Crank with a Variable Throw.—If your disk is well made of solid material, the holes bored true, the crank pin well fitting, and secured solid with a nut behind, we do not see why such an arrangement should not be satisfactory. The objection may be that you are confined to the holes, and that it takes too long a time to change their position; in that case we recommend an eccentric with a slit running radial from the center to near the circumference. If you fix this eccentric so that the axis will be near the center, the throw will be smallest; if you fix it so that the axle will be near the circumference, the throw will be largest, and any intermediate position gives you an intermediate throw; thus with an eccentric of say 16 inches in diameter, you will be able to change the throw from a fraction of an inch to 7 or 7½ inches. Such an eccentric has an advantage over your arrangement as it can be applied to the middle of the shaft, while your disk arrangement can only be applied to the end of the same.

(2415) Estimate of Water Power.—Twenty-five horse-power is equal to 25 times 33,000 pounds of water falling 1 foot in 1 minute—that is, 825,000 pounds, or nearly 100,000 gallons falling 1 foot, or 10,000 gallons falling 10 feet in one minute. If you find that a water power discharges every minute 10,000 gallons of water from a hight of 10 feet, you have 25 horse-power; however, you must remember that practically you cannot realize all this power, but come only more or less near to it, in proportion to the kind of water-wheel you use. With old-fashioned wheels you will only realize about 50 per cent; with improved turbines, from 85 to 90 per cent; so in order to obtain fully 25 horse-power with an old-fashioned water-wheel, it takes 20,000 gallons falling 10 feet per minute; for a turbine wheel, some 12,000 gallons per minute will do. The calculation of the required velocity of the current of water leads to much uncertainty; however, for a rough estimate you may go on the principle of applying the velocity acquired by water freely falling through a perpendicular hight of 10 feet, which makes it 20 feet per second; if 18,000 gallons per minute, or 300 gallons per second, run with this velocity, it ought to give 25 horse-power. This, however, is an excessive velocity of about 50 miles per hour, which we may reduce by increasing the amount of water in proportion, and say 1,500 gallons per second, running with a velocity of 4 feet per second.

(2416) Difference in Level of the Atlantic and Pacific Oceans.—The results of the nivellation of the different surveying parties disagree so much that there is a reluctance among them to make definite statements of how much difference in level they found; and this is not surprising, considering the great hight of the mountain range to be crossed and the hot air always surrounding the surveyors and their instruments in that climate, which must affect the correctness of the observations. We must remember that the difference in level between the Red and Mediterranean seas, predicted to cause a strong current in the Suez canal, has turned out not to exist, as the canal proves that the two seas are at the same level, (see answer to Query 2287, page 48 of our last February number). The difficulties of high mountain chains between these two seas do not exist at Suez, and if there an erroneous result was obtained, it is still more likely to have been the case at Panama, as the disagreements, referred to, prove. We expect that the two oceans will be found to be at the same level, but the conditions will be somewhat different from those existing at the Suez canal. At the latter the prevailing winds cause a difference and create currents, while the tides amount to little or nothing; at Panama, on the contrary, the ocean tides will have an influence and will cause, in combination with the prevailing winds, alternate currents in both directions. In fact, we see no reason why there should be a difference in level, as the terrestrial gravity cannot be greater at one side of the isthmus than at the other, and it is terrestrial gravity that determines the level of the ocean, as proved by the disturbance of gravitation by lunar and solar attraction, causing the daily tides, which are nothing but a temporary change in the ocean level, so as to obey the law of gravity.

(2417) Expansion Joints in Steam Pipes.—For great lengths of steam pipes it is absolutely necessary to make some provision for expansion and contraction, which will loosen any joint if the pipes are solidly fixed at the ends. The same trouble was experienced in the Cooper Union building in 1859, and we had it remedied, without expansion joints, by making several elbow and U joints, thus:



It is clear that if this set of pipes is fixed immovably at A and D, it may contract and expand without loosening any joint, as expansion by heat will only tend to bring the bends B and C closer together, and contraction by cold to pull them farther apart; this will only bend the pipes at B E a little without pulling any joint apart. However, we recommend sliding expansion joints as the simplest.

(2418) Casting vs. Stamping.—As far as our information goes, elaborate capitals of cast-iron colums are always cast separately and slipped over the top, which is cast with a collar to keep the capital in place. Of course such iron ornaments always cost considerably less than stamped galvanized iron, for the simple reason that it costs much less to make a pattern to mold and cast from than to make the steel pieces with which to stamp ornaments; then the stamped capitals have to be put together, which incurs labor, while a cast-iron capital is completed at once. The large capital on our title-page is intended to represent cut stone.

(2419) Strain on a Piano by the Strings.—The tension of a piano string varies from 100 to 200 pounds, and even more; it is least on the ordinary square piano, more on the upright, and most of all on the grand. An ordinary seven octave square piano, with 2 strings to each note, has 170 strings, and therefore suffers a strain of 170×100, or 17,000 pounds; upright pianos have more room inside, and therefore usually 3 strings to each note—at least for the greater number, the base having usually only 2 strings for each note—say 230 strings, at 120 pounds each, a strain of 27,600 pounds; a seven octave grand piano, with 3 strings to each note, has 254 strings, which, at 150 pounds each, exert a strain of nearly 40,000 pounds; while the largest kind of concert grand pianos, 7½ octaves, have 3 strings throughout, or 260, of a somewhat heavier kind and larger than those on other pianos, therefore they are much more stretched to bring them up to the right pitch; the average tension required is 230 pounds each, which, for the 260 strings, makes 260×250, or 65,000 pounds.

(2420) Is Canned Food Dangerous?—We have found traces of lead in canned tomatoes, which fruit, from its sourness, first excited our suspicions, especially as we have always found the tin on the interior of the cans to be very bright, which is caused by all oxidized coats being constantly dissolved by the acid in the tomatoes. It is the same with peaches, but in a less degree, as they are not so sour. We, however, did not much suspect substances like beans, corn, and various kinds of meat, which are not acid; but the German papers report the following item, which we recommend to those who make extensive use of canned vegetables and meats: "The Board of Health of Carlsruhe, Baden, publishes a notice stating that chemical analysis shows that the outer portions of American canned beef, which have been in contact with the tin of the case, are impregnated with the lead, and are injurious to health. Consumers are advised to cut off a thin paring on all sides of the package before using the meat."

(2421) The Treatment of Imaginary Quantities.—That you are wrong and the book is right, is evident from the fact that you can reduce the results of the book to the original expression, and not your results; -4 can never be $= \sqrt{-2} \times \sqrt{-8}$; nor $-48\sqrt{3}$ be $= \sqrt{-256} \times \sqrt{-27}$; neither is $-4\sqrt{6} = \sqrt{-2} \times 4\sqrt{3}$. You forget that the square of a negative number is always positive, and that therefore the root out of a negative number cannot exist, and is an imaginary quantity; but while, as numbers, they do not exist, in analytical geometry they represent certain lines obtained in the solutions of some problems; not only $\sqrt{-x}$, but also $-\sqrt{-x}$, may represent a line. Your trouble is that you have not learned how to treat imaginary quantities; the correct way is to reduce every term affected with the root of a negative number to the general expression $\sqrt{a} \times \sqrt{-1}$, therefore the method of solving the examples given is this: $\sqrt{-2} \times \sqrt{-8} = (\sqrt{2} \times \sqrt{-1})(\sqrt{8} \times \sqrt{-1}) = \sqrt{2} \times \sqrt{8} \times \sqrt{-1} = \sqrt{16} \times \sqrt{-1} = 4\sqrt{-1}$; $\sqrt{-256} \times \sqrt{-27} = (\sqrt{256} \times \sqrt{-1})(\sqrt{27} \times \sqrt{-1}) = 16\sqrt{-1} \times 3\sqrt{3} \times \sqrt{-1} = 16 \times 3\sqrt{3} \times \sqrt{-1} = 48\sqrt{3}\sqrt{-1}$; $\sqrt{-2} \times 4\sqrt{-3} = 4\sqrt{-6} = 4\sqrt{6} \times \sqrt{-1}$. These results can be reduced to the original form, and this is the proof of the sum; for instance, $4\sqrt{-1} = \sqrt{16} \times \sqrt{-1} = \sqrt{-16} = \sqrt{-2} \times \sqrt{-8}$. You ought to have been told that while $-1 \times -1 = +1$, this is by no means the case with $\vee -1$, because $\vee -1 \times \vee -1$ is not at all $= +1$; neither is it -1, as you appear to have supposed and worked out the problems accordingly; $\vee -1$ is an expression which neither can nor must be squared, but remains attached to any algebraic expression affected by it, like an indestructible coefficient. Strange and unnecessary as these imaginary quantities may appear in elementary algebra, the roots out of negative quantities form a most important element in the higher branches of mathematics. *Note.*—We do not like the English name "imaginary quantities" for algebraic expressions of this kind, as in reality they cannot be imagined, because they cannot exist. They ought to be called "non-existable" quantities, a word compounded after Herbert Spencer's example, who invented the word "unthinkable," for those things which the human mind cannot possibly grasp. The German and the Dutch names for these imaginary quantities, when literally translated, mean unexistable quantities.

(2422) Making Pure Vegetable Acids.—As to the profit in this business, we believe that it would pay much better if carried on where the lemons grow than to do it here where the cost of transportation and trade profits are added, while the worst thing would be the deterioration which lemons undergo when transported to a distance. When old they become either rotten or dried out, or increase in sourness; this latter increase is the formation of acetic acid, which causes a direct loss when it is attempted to make citric acid, as this acid is not crystallizable, but volatile. The best way to utilize lemons here, when they are too plentiful to use at once and have to be kept, is to press them, strain the juice, and sweeten it with plenty of white sugar; then it will keep any length of time, and can be used for lemonades, punches, etc., without the addition of sugar. The juice cannot be kept long, except perhaps when salicilin is added, which we have not yet tried. In order to make the pure citric acid, it is best to establish the works in a locality where lemons can be procured as fresh as possible from the trees. They are first peeled, and the peels used to make oil of lemon, of which we will speak hereafter, in answer to another question. Then the seeds are removed, as far as practicable, and the fruit is put into a small wine or cider press. The juice is strained if necessary, and evaporated in earthen or iron enamelled vessels, care being taken not to raise the temperature above 200° Fah. This evaporation is continued until the liquid is found to indicate, by the hydrometer, a specific gravity of about 1.22 to 1.25. In order to eliminate the large amount of foreign matter, mostly in suspension, but so minute, that no straining can separate it, use is made of the property of lime to combine with vegetable acids; and the same method is used as that for making pure acetic, tartaric, malic, and other vegetable acids. Carbonate of lime, in the form of finely pulverized Paris white or French chalk, is gradually added until effervescence ceases; the latter is the sign that the citric acid present is saturated with lime, and that no free citric acid is left, as its presence would decompose the carbonate of lime and drive the gaseous carbonic acid out. It is evident that the chalk must be added gradually and in small quantities, and the mixture continually stirred. The mixture is then allowed to settle, when the citrate of lime will precipitate, while the supernatant fluid is drawn off. The precipitate is then repeatedly washed with warm water, so as to remove all foreign substances, every washing being accompanied by agitation, subsequent settling, and decantation. In order to separate the citric acid from the lime, the same principle is applied. As the citric acid drove out the weaker carbonic acid from the chalk, so the stronger sulphuric acid is used to drive out the weaker citric acid. A quantity of sulphuric acid equal to the amount of chalk used, is mixed with six times its weight of water, and mixed while hot, with the washed citrate of lime, which is then decomposed into free citric acid, while the sulphuric acid combines with the lime into sulphate of lime or hydrated gypsum, which precipitates, while the citric acid, being very soluble, remains in solution. After allowing the mixture to settle, the clear supernatant liquid is drawn off and evaporated. The best way to do this would be in vacuum pans, heated by steam; it is then drawn off through filters, either of canvas or filled with bone-black, and allowed to run into pans, where it cools and crystallizes. The crystals are scooped out and dried, and form the citric acid of commerce. If bone-black is used, it is well to first free it from lime by treating it previously with hydrochloric acid, as otherwise an amount of citric acid would be lost equivalent to the lime contained in the bone-black.

(2423) Making Ethereal Oils.—Considering the enormous amount of lemon and orange peel wasted, we think it would be worth while to utilize the valuable oils contained in them. The process is very simple—the same as for all substances containing flavors, even rose leaves. If you cannot collect enough fresh material at one time to begin operations, salt the peels in barrels as you would pork, because if you let them dry out you lose most of the volatile oil, in which especially the skins of fresh lemons and oranges are very rich. When you have collected and preserved a sufficient quantity, put them in an ordinary still with water, and your distillate will first be orange water, or water flavored with lemon peel. As the distillation proceeds the distillate becomes over-saturated and the oil will float on top. You can draw the water from the bottom of the receiver and put it back into the still, and thus increase the amount of oil, until the peels are exhausted, when a fresh charge is put in. The process is the same for other ethereal oils.

(2424) Motion on Rough and Smooth Inclines.—It depends upon what you call smooth. If the road is so smooth that the horses cannot get a foot-hold, the smooth road will be the most difficult; but as long as the horses can get a foot-hold the smoothest road is always the best. It may be argued that when the horses cease to pull, the load runs easier backward on a smooth road, while on a rough road the resistance may be so great that the load will stick and not run backward at all; but if this is the case, and hollows are so deep that the wheels will not roll down the incline, it will be so much more difficult to pull them out of the hollows up hill. So, taken all in all, you are right, and the smoothest road is the best so long as it is not smooth enough to cause the horses to slip.

(2425) Single and Double Cream.—Single cream is called that which is skimmed from milk when it has stood 12 hours; and double cream when it has stood 24 hours. For making butter, the milk is usually left 48 hours in a cool place. The cream is churned, and the remainder of the milk is usually strained for making cheese.

(2426) Electric Telegraphs in Russia.—Since the late Turkish war telegraphs have been considerably extended in Russia. Thus far we have no statistics in regard to this extension, but before the war the telegraphs extended over nearly 42,000 miles, using 80,000 miles of wire. The number of government telegraph offices was 800, and those connected with railroads more than 1,000.

(2427) Coal Production of Belgium.—The only information we have at hand is a report of 1877, which states that the year previous the total production was over 14,333,500 tons.

(2428) Coal Production of China.—Coal mining in China is in full operation, and the present production is estimated at 3,000,000 tons per year, of which 1,000,000 tons is anthracite and the rest bituminous. It is used for steamships and steam boilers, but the home market is largely extending.

THE MANUFACTURER AND BUILDER.

Vol. XI.—No. 8. AUGUST, 1879. ELEVENTH YEAR.

Improved Compact Steam Engine.

We have had the pleasure of examining a new and improved steam engine, which is intended to supply the demand for a simple, compact, durable and reliable motor from 2 to 20 horse-power. We represent it in the adjoined engraving, (Fig. 1), and the mere examination of the figure will show to any expert in this matter that it is quite different from the various kinds of small engines now in the market, which fail to give satisfaction, for the simple reason that they are merely enlarged toy engines, of inferior workmanship and cheap material, and of a design defective in regard to the proportion of their moving parts, especially in their wearing connections, giving little or no chance to take up the unavoidable wear. Such engines in a short time require expensive renovation, or are rejected, necessitating a new purchase, which, besides the pecuniary loss involved in it, is always a great vexation to any one using steam machinery.

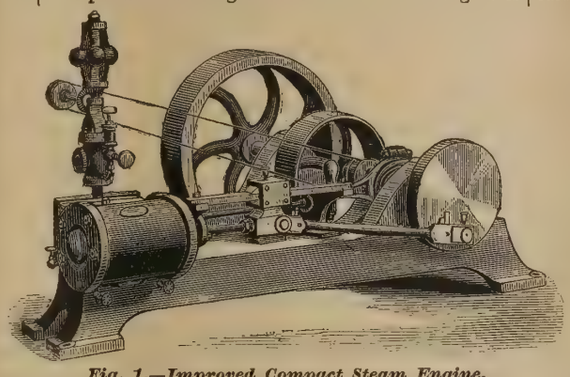


Fig. 1.—Improved Compact Steam Engine.

The machine here represented has a cylinder of 6¼ by 8 inches, is intended to run at 60 pounds pressure, and to make 185 revolutions per minute; it is of 5 horse-power, but others are also built of from 2 to 20 horse-power, costing from $125 to $375 — the intermediate sizes in proportion. They are claimed to be reliable, which claim we can endorse, as an inspection shows a superior design, bringing the greatest strength exactly in the direction of the greatest strain, while the beautiful proportions of the different parts secure an easy motion and a minimum of wear. The latter quality we especially acknowledge, as the workmanship reminds any practical mechanic of the locomotive type, and it is well known that no engine requires more care in its construction than a locomotive, which otherwise soon breaks down, as was the case when they first began to be used, mechanics not having yet learned to construct reliable locomotives. This they now do, and it would be very desirable to have all small engines constructed in so reliable a manner, for the simple reason that they never have such skilled engineers to attend them as those having charge of locomotives. A well made and reliable little engine can more safely be entrusted to a young, inexperienced engineer than a badly made one, which often requires the utmost skill of an experienced man to keep it in working order.

The bed plate of this engine, being cast in one single piece of an L shape, so as to carry the outside bearing of the crank shaft, keeps the working parts always in line, even if it is placed horizontally, inclined, or vertically, and will in no case show unequal wear, as all rods, pins, etc., are made of steel.

A peculiar and ingenious feature of this engine is that the end of the rod driving the slide valve is used as the plunger of the feed pump, if one is desired, the eccentric being made strong in proportion to this extra labor depending upon it. It is evident that in this way a very cheap, simple, durable and reliable feed pump is obtained without additional complication, and that it is easily added to or removed from any engine of this kind.

We also represent on this page two small hoisting engines, built on the same plan. Fig. 2 is similar to the engine represented on page 154 of our July number, but detached from the boiler, and placed upon an independent frame, for the use of such parties as already possess sufficient boiler power.

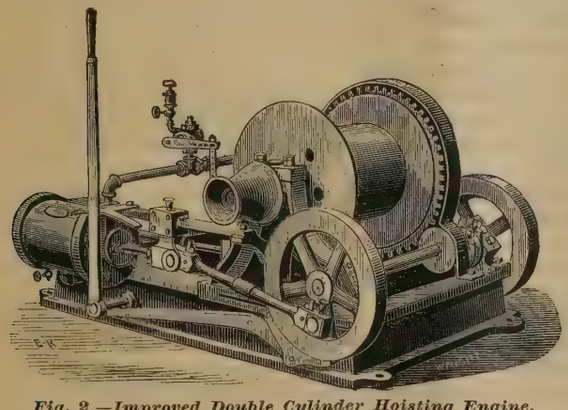


Fig. 2.—Improved Double Cylinder Hoisting Engine.

Fig. 3 represents an improved hoisting engine with a double cylinder, double friction drums, and a brake. It is especially designed for use on board of steamers for hoisting general cargo, coaling up, etc. It will also be found very effective in many other places where two hoists can be worked to advantage. It is simple, compact and powerful, easily operated and cared for. Its cylinders are connected upon one crank shaft, at right angles, therefore both of them do a portion of the work upon either drum. Both drums are upon the same shaft, with the driving spur wheel between them, which works into the pinion upon the crank shaft. The drums are fitted with an improved friction with independent foot brakes. The cylinders are also connected together by cross steam and exhaust pipes, with two throttle valves, so arranged that steam is admitted to both cylinders by using either one of them from the side it is placed upon; therefore the whole power of both cylinders can be applied to both drums, or to one, or divided, as desired by the operator. Each drum is also fitted with a substantial foot brake, which will hold and lower all the weight both engines together can lift.

The drums, when used separately by two parties, each attends to his own drum, applying his brake for lowering or holding the load; all the extra care necessary is to supply more or less steam, which either party may do according to his wants, by the throttle valve upon that side.

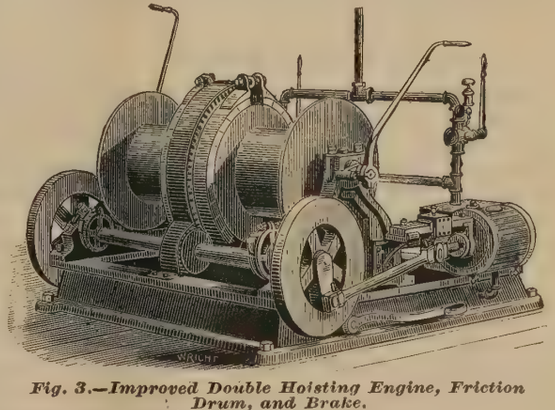


Fig. 3.—Improved Double Hoisting Engine, Friction Drum, and Brake.

These engines are built by the Lidgerwood Manufacturing Company, of 96 Liberty street, New York, and are made extra strong and of the best material, with superior workmanship, and are adapted for all kinds of hard service and rough work. They also make the same styles with boilers and fixtures, all complete upon the same frame, as represented on page 154 of our July number. For coal yards, docks, etc., they will be found a good, reliable, and convenient kind to do work with. They also make the ordinary kind of double friction drum, with boiler between the drums, each drum having its own engine, etc.

American Mineral Wax.

For some time there has been in the trade a mineral wax, from Austria, called "osokerite." It is very much like beeswax, except the honey flavor, and is now largely used for the adulteration of beeswax, white as well as yellow, as this osokerite can also be obtained bleached, when it is as white as white beeswax, and is sold as such at a great profit, as it does not cost half as much.

It appears that we have everything on this continent, and that often better and in greater quantities. This is the case with this substance also. It is reported that an immense bed of this, or a very similar substance, has been discovered in southern Utah and Arizona, and we expect that this discovery may turn out to be as important as the petroleum discoveries in Pennsylvania. The substance is similar to the Roumanian mineral wax called "zietriskisite," as verified by Prof. Henry Wurtz, of Hoboken, N. J. The beds here are said to cover many miles of surface, and reaching to a depth of 20 feet, while in Europe it is found in comparatively small quantities.

We ought to add that the difference between these substances and paraffin is that their melting point is higher, while they do not dissolve in ether, as paraffin does, therefore they are much better adapted for the adulteration of wax than paraffin is, which is very easily found out, paraffin being semi-transparent, while this substance is more opaque.

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Vol. XI. No. 8. ELEVENTH YEAR.

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Studies Useful for Business.

No one who has intelligently observed the immense progress made at the present day in various branches of pursuit, such as building, manufacturing, methods of transportation and of warfare, intercommunication by post or telegraph, grand engineering enterprises, etc., and who reflects on the causes of this progress, will soon come to the conclusion that it is all due to applications of modern science. The most conservative ignoramus in science, whose only pride is that when young he studied Latin and Greek at a college or university, and was graduated so as to be a Bachelor of Arts, or write after his name the letters LL.D., A.M., or any other appendage, considered honorable in times gone by, will be compelled to acknowledge that none of his studies have contributed one iota to this progress, and that they never have done so. Ancient languages were taught for centuries, and the human race remained stationary. Even the glorious invention of printing, so long as it was confined to diffusing literary knowledge, contributed very little to the world's material progress; but as soon as it was applied to proclaim the triumphs of science and diffuse knowledge of the all-important facts discovered by scientists, not only the condition of human society, but of the surface of our planet, became changed, and this in such a ratio that the outlook indicates that the changes in the next half century will be even greater than they were during several centuries passed.

This may appear incredible to some, but we refer back three or four decades, and remind doubters that forty or fifty years ago the public was so astounded at the innovations based on scientific pursuits, that the generally prevailing opinion was that the ultimate point had been attained, and that there was little left to invent or to improve. Now we all know that during the last fifty years new inventions of practical value, and important improvements on older inventions, have been more frequent and valuable than the aggregate during one hundred years preceding that time.

The desire to learn is very praiseworthy, but it is a misfortune that this desire is so misdirected as to make a great deal of the effort useless, simply by reason of an injudicious choice, based on a custom that originated at a time when true science had scarcely any existence, and when what was called the natural sciences was scarcely worth that name. Indeed, what did natural history amount to at a time when the classifications that had been attempted were founded on an utterly wrong basis, and therefore very defective, as well in zoölogy and botany as in mineralogy, and when geology did not even exist. What did chemistry amount to before the true elements had been determined? and even much later, before the science of analyzing organic compounds had been invented? What did even physics amount to, with its doctrine of the imaginary imponderable fluids or ethers, such as caloric, electric, magnetic, luminiferous, etc.? It was only elevated to a level with chemistry, (which had taught the indestructibility of matter,) when physics taught, and this only recently, the indestructibility of force, and its convertibility into the phenomena of molecular motions, known as caloric, electric, etc.?

As these sciences, amounted to comparatively so little, and that little very imperfect and uncertain, it was not surprising that the study of the classic languages, in which so many masterpieces of literature had been produced, was considered the main object of a solid education, especially as at the time when the custom was established of considering them as such, science, whatever there was of it, had not put the seal of its influence upon the world, as is the case in our day.

The result is what might have been expected; those whose training has been confined to the classics, feel themselves behind the times in which they live, because they are ignorant of many things which they feel they should know, being immediately interested in them; while those who, instead of having received a classical education, have been trained in sciences and their technological application, possess a decided advantage over their supposed superiors with their so-called higher learning.

We are very well aware that it is claimed in the universities that all the students receive instruction in physics and chemistry as there are professorships in these branches; but we ask: What does it amount to, when this instruction is confined to hearing a lecture, and perhaps seeing a few experiments, two or three times a week, when most of the time of the student is occupied with linguistic studies, and scarcely any time is left for studying the sciences, which require not only the aid of mere memory, but, for a proper understanding, the more important, but unfortunately, too much neglected exercise of the powers of scrutinous observation and practical judgment.

It is even pretended that in our public schools physics and chemistry are taught, but there matters are still worse, the instruction is usually confined to the memorizing of lessons from some text-book, while the teachers themselves frequently do not know any more about it, and are incapable of giving clear explanations, because how can a thing be explained when he who tries to explain it has not fully mastered the subject? Matters are usually no better in boarding schools.

To improve this condition of affairs, recitations from scientific text-books should be abolished in schools, and the sciences taught as they are now taught in universities—by lectures and experiments; while in universities the students should, after having gone through a course of lectures in the schools, enter the laboratory and learn to make experiments and observations themselves, as is done in those institutions where students really learn something of science—for instance, in the Stevens Institute of Technology in Hoboken, N. J.; the School of Mines of Columbia College, New York, and a few other live institutions, where the leading minds understand that the wants of the nineteenth century are to prepare the students for business in actual material life, and not for the contemplation of abstract literature.

Making Death Sure.

There are various ways in which we may prevent our deceased friends and relatives from being buried before they are really dead. The most common way is that which has been made fashionable by our undertakers, that is, to put the body on ice; this will freeze out any spark of vitality that may perhaps be left, and which, by keeping the body warm, might be rekindled into life again. It is true this is not common, but statistics taken from those burial grounds in Germany where precautions are taken against the possibility of premature burial, have shown that one in every thousand persons supposed to be dead, can be resuscitated. As in New York city we bury 40,000 persons a year, there are 40 persons buried alive every year, some of whom become conscious again in their graves, but the majority die in their graves, remaining unconscious, who could have been restored if proper means had been applied.

Placing bodies upon ice is not, after all, so certain a way to secure death, as recent experiments have shown that animals may be frozen to death and again restored to life, if only carefully thawed out, and it is proposed by the *Brisbane Courier* to apply this method to the transportation of cattle, and even to the preservation of men who want to be put out of the way for say 20 years, and then revived.

In regard to this, the eminent English physiologist, Dr. B. W. Richardson, says in *Nature:* "Even should the description given prove to be overdrawn, I am not sorry that it has appeared, since it has afforded a reason for relating to what actual extent human knowledge has been advanced by experiment. This is important as an introduction to those great events which in the future are sure to come from the positive results that have already been secured, and for which the world should be prepared, without anxiety or amazement."

He says this at the close of an article on suspended animation, in which, besides the effect of cold or frost, he mentions various medical agents which may be made to perform the same functions; they are, mandragora, atropa, belladona, nitrate of amyl, woorali, chloral hydrate, cyanogen, alcohol, and oxygen. To these we may add ether, chloroform, and laughing-gas, which may all produce death, but if used with precaution, may merely suspend animation and make a resuscitation possible, but on the other hand, if used in abundance, will, as well as the other substances named, produce death.

The other more certain remedy to prevent resuscitation is a post mortem examination. By such an operation, the body is so cut up that life become impossible afterward, and death being certain, a premature burial is impossible.

These thoughts are suggested by a recent murder case in this city, where the body of an otherwise healthy woman was found suffocated four hours after the commission of the crime. Instead of applying means of restoration, of which there was a chance—even one in a thousand was worth trying—the undertaker was sent for, and he put the body on ice, thus extinguishing whatever little vitality there may have been left, while afterward a physician, by making a post mortem examination, made certainty doubly sure.

That a duration of four hours of suspended animation is not too long to warrant us to give up attempts

to restore life functions, has been proved over and over again. Cases are on record where, under such circumstances, and with proper efforts continued for eight hours, at last life was restored—thus twelve hours after the suspension of the life functions, while spontaneous restorations, after the body had lain for a couple of days, and been prepared for burial, have been recorded in more than one instance—resembling veritable resurrections.

A third method, equally as certain to kill as post mortems, is cremation; but this is not popular, and very rarely applied. The objection is that the almost utter destruction of the body makes it impossible to hold a legal investigation as to the cause of death, occasionally found necessary afterward.

A fourth method is embalming and petrifying; this certainly extinguishes life as effectively as a post mortem, as it begins with similar operations.

The best and simplest of all methods to prevent a premature burial, and to be certain that the body is dead, is to wait and see if decay begins. This always manifests itself very soon in the region of the stomach or abdomen, which shows a greenish discoloration. This sign is proof of beginning putrefaction, and the latter will certainly not take place before the last spark of vitality has been extinguished. Other signs reputed as being signs of death are worthless, such as placing a mirror over the mouth to see if watery vapor condenses, tying a string around a finger to see if it swells, pinching or pricking the skin, etc., as these signs are based upon the false theory that when respiration and circulation have ceased death has taken place. The fact is, that death only begins afterward, when putrefaction sets in; cessation of respiration and of the circulation of the blood are only events which may lead to death, and in 999 cases out of 1,000 do lead to death, but in one case at least out of a thousand life may be recovered, when ice is not applied or a premature burial performed. Let us then save one man out of a thousand; it will amount to forty persons buried alive per year in New York city alone.

Proper Location for Railroad Depots.

The question as to what part of a large city a railroad depot should be situated, in order to offer the best convenience for public travel and transportation, is becoming of more and more importance with the growth of the city and the extension of its industry. Experience is teaching New Yorkers that the location of the Grand Central Depot is as much a serious blunder as its interior arrangement is based on another mistake. As it is the custom for all railroads trains to keep the right-hand side of the road, the trains should leave and arrive at the corresponding sides of terminal depot where the tracks end; instead of this, however, in the Grand Central Depot the departures and arrivals take place at the opposite sides, because the waiting and baggage rooms have been located on the wrong side of the depot, (on the west side instead of the east—the tracks running due north). The result is that all trains must cross opposite tracks—the down trains arriving at the western side of the track must cross over toward the east side of the depot, and all the departing trains, leaving the west side of the depot, must cross over toward the east side of the track. As trains arrive and depart by the hundred, this arrangement is a very dangerous, and only a most elaborate system of signals by electric telegraphic connections between the headquarters at depots and flagmen and switchmen, has thus far prevented any serious accident.

In regard to the location, especially since rapid transit by elevated railroads has been in operation, it is evident that the Grand Central Depot, with its tracks for steam cars, is in the way; it ought to be out of the central part of the city altogether. As it is now, an inhabitant of the northern districts, living near the road, has to travel many miles south to the depot, and then when on board the cars passes his home again. The depot should have been located north of the Harlem river, a point which, in the course of time, when the lately annexed districts become densely populated, will be central. From that point wisely planned schemes of elevated roads would have fully accommodated the city of New York; but the present location of the depot involved an impediment to travel east and west, which was the means of sinking millions of capital in unproductive sunken tracks in mason work, and interferred for years with any efficient scheme of rapid transit that would benefit the whole city.

But whether we like it or not, there stands the depot at Forty-second street; that spot connects New York with all the large cities of the Union with which we are connected by railroad. Millions of people who do business in this metropolis are poured through this narrow channel into our city, and the great capitalist who controls this depot and most of the railroads leading to it, seeing the enormous success of the elevated railroads in other streets, now wants to connect this depot direct with the City Hall Park, passing through a great deal of private property, which has to be purchased for the purpose. The plan meets with strong opposition, which is, of course, chiefly nourished by the existing elevated railroads.

Mr. Vanderbilt confessses that the success of the elevated railroads is very unexpected to him, that neither he nor his father had any confidence in that success, otherwise those roads would have been constructed by them long ago, as the surveys, plans and estimates were made, but not used for the reason stated.

It may be interesting in this connection to state that the Spiritualists have been the cause of the construction of these roads having been so long postponed. It is well known that Mr. Cornelius Vanderbilt, Sr., often consulted Spiritualistic mediums on business affairs, and their advice was sometimes found successful; but as they invariably warned him against constructing elevated railroads, because people would not dare to ride on them, he followed their advice, and left undone an enterprise for which he had the necessary charter, and, what is the principal thing, he alone could have commanded the money with which to accomplish the work.

We believe that under existing circumstances it would be an accommodation to the public to have a rapid transit road constructed direct from the Grand Central Depot to the City Hall, from the depot across town to both rivers, and also up-town a sunken rapid transit along Fourth avenue parallel to the present steam railroad, and extending over the Harlem river, as it would be very desirable that steam roads should render available that beautiful section of Westchester county bounded on one side by Yonkers and on the other by New Rochelle. There are beautiful building sites scattered all through this region, and it is destined to furnish homes for hundreds of thousands of working people who make New York a great manufacturing center, and are the principal producers of our wealth and abundance.

The Poetry of Science.

It is a common complaint that we live in an age of materialism, that the tendency of modern science is to explode the poetry of past ages which gave those of our ancesters who were refined by learning, such rapturous delights, and in which even the multitude found consolation from the hard labor which is the destiny of ordinary men. Even if many of the poetical conceptions of former times were based on error, they made men more happy than they can be when, with the exposure of the error, this consoling conception is taken from them.

We hold that in return for the childish conceptions of the universe, with their quasi poetical tendencies, which science has annihilated, she has given to the world much grander conceptions, which, when once well understood, convey to the mind a poetry so sublime as to be beyond the comprehension of common minds, but which may be reached by such mental labor as is spent to obtain possession of what is true; and truth in nature is the most beautiful of all attainments.

A most happy expression of the above ideas was lately given in truly poetical language by the well known French philosopher, August Renan, on the occasion of the inaugural address he delivered before the French Academy, of which he had been elected a member. We can do no better than give a translation of his words. Referring to the change which science has made in our views of nature, he remarked:

"Who does not see that Galileo, Descartes, Newton, Lavoisier, Laplace, have changed the foundation of human thought in modifying totally the idea of the universe and its laws; in substituting for the infantile imaginings of non-scientific ages the notion of an eternal order, in which caprice and particular will have no thought? Have they diminished the universe, as some think? For my part, I think the contrary. The skies as we see them are far superior to that solid vault spangled with shining dots and upborne some leagues above us by pillars which contented the simpler ages. I do not much regret the little spirits that want to guide the planets in their orbits; gravitation does the work much better, and if, at times, I have a sad remembrance of the nine angelic choirs wheeling round the orbs of the seven planets, and of the crystal sea that lies at the feet of the Eternal, I console myself with the thought that the infinite into which we look is really infinite, and a thousand times more sublime to eyes of true contemplation than all the azure circles of Angelico of Fiesole. M. Thiers rarely allowed a fine night to pass without gazing upon that boundless sea. 'It is my mass,' he said. How far do the chemist's profound views upon the atom surpass the vague notion of matter on which the scholastic philosophy was fed!"

Of the influence of science upon character he says:

"And as to nobleness of character, how can one accuse science of striking at it when he sees the minds that science forms, the unselfishness, the absolute devotion to life work, that she inspires and sustains? With the saints, the heroes, the great men of all ages, we may fearlessly compare men of scientific minds, given solely to the research of truth, indifferent to fortune, often proud of their poverty, smiling at the honors they are offered, as careless of flattery as of obloquy, sure of the worth of that they are doing, and happy because they possess truth. Great, I grant, are the joys which a firm belief in things divine confers, but these the inward happiness of the wise equals, for he feels that he toils at an eternal work, and belongs to the company of those of whom it is said, 'Their works do follow them.'"

Perpetual Motion in Disguise.

We saw recently at the rooms of the American Industrial Exhibit Company, in this city, a working model of a machine that is claimed by its inventor to convert the muscular efforts of a boy into 50 horse-power. The machine consists of a complicated gearing, working a small wooden pump for lifting water; the gearing is put in operation by two rubber springs, which it is intended the boy shall wind up. When wound up, which only takes a few minutes, they can be made to move the wheel-work by being set free to act; as soon as this is done, a crank works the little piston in the pump quite rapidly, making quite a display in churning water, and elevating some of it. In a short time the springs run down and the pumping stops. It is evident that the force spent here is only that stored up by the winding up of the springs, and which is only given back with the necessary percentage of losses by friction, etc.

If an inventor claims that by gearing, or any other machinery, he can transform the power of a boy into that of 50 horses, it is just as absurd as to claim that when you put ten cents into your empty pocket you can take out fifty dollars. It proves that the inventor has no knowledge of the first principles of mechanics, and has been wasting his time in vain pursuits, not being aware that you can never get more power out of a machine than you put into it. But people in general are little prepared to understand the fundamental princi-

ples of what constitutes power, therefore an explanation of the fact that time and velocity of motion must be taken into account when we estimate power, falls usually on barren ground. They have so often seen a man raise half a ton weight or more with a windlass, that they think there is really a gain of power here, and that the machine actually increases the man's power into that of a horse, forgetting the element of time, which is a most essential condition, as all know who have a little knowledge on the subject.

Our explanation, therefore, given to the parties present at that exhibition, had little effect in convincing them; but as they acknowledged the utter impossibility of perpetual motion, we hit upon a suggestion which conveyed to their minds the absurdity of the claims made for the machine. We suggested that the inventor should make two such machines, let the boy wind up machine No. 1, and while it is exerting its 50 horse-power, let a small portion of this power be used to wind up machine No. 2; when this is wound up, let it in its turn exert 50 horse-power, using a part of it to again wind up machine No. 1, which then will be ready to recommence as before. By such an arrangement the boy can even be dispensed with, and perpetual motion will have been established.

This suggestion had more effect than our elaborate explanation of the amount of power of a boy compared with a horse, and estimated in foot-pounds per minute; it carried conviction to the minds of all that the whole affair was an absurdity.

Improved Damper Regulator.

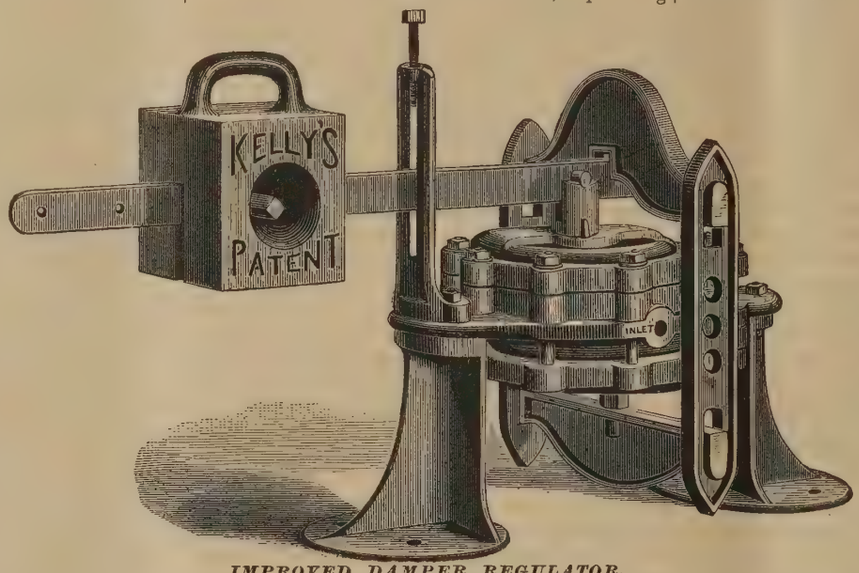
We hold that a regulator of the draft in the flues of a steam boiler is as necessary for both boiler and engine as a governor is necessary for the engine alone; and as nobody denies the absolute necessity of a governor, nobody should deny the absolute necessity of a damper regulator, especially when it is recollected that the governor only regulates the admission of steam to the engine, increasing or diminishing it automatically, according to the wants of the work done by the engine; but it does not, and can not, increase or diminish the generation of the steam, as it cannot open or shut the damper.

In a way similar to that in which the governor controls the speed of an engine, and keeps it at a uniform velocity, even when variable demands for power are made upon it, so the damper regulator here described controls the pressure in the boiler and keeps it uniform, even when variable amounts of steam are drawn from it, and this by regulating the activity of the combustion of the fuel in the furnace, according to requirements.

The common practice of engineers of throwing the furnace doors open when it is found that the pressure exceeds the desired hight, is of course good in view of safety, but it is certainly not good in regard to economy, as it allows the cold air to enter and aids the hot gases to escape very rapidly up the chimney without giving their heat to the boiler; so that with a damper regulator that will timely check the fire, economy is attained, as well in regard to the saving of heat as in the overheating of grate bars and boiler plate, not to speak of the prevention of possible explosions by too high a pressure, as the regulator is so arranged that it may be set at any pressure desired, and in this way it acts as a check on the safety valve and the steam gauge, and if these are out of order, the damper regulator will indicate the same.

This damper regulator is represented in our engraving, and is very simple in construction. There are two rubber diaphragms used, which are simply circular pieces of three-ply rubber packing of first-class quality, such as can be bought in any hardware store. They do not have to be "formed" in a mold, and as the motion of each diaphragm is very slight, there is but little liability of their wearing out, and in any event it is but the work of a few minutes to replace them. The regulator is very sensitive, being made on the same principle as a scale beam, the pivots being of steel and "knife edged." It is claimed to be more powerful than any other regulator of the same size, as, from its design, there is less loss by friction than in any other regulator now made, and greater power can be obtained from the pressure of the steam in the boiler than from the mere weight of a fixed quantity of water, as is sometimes made use of.

These regulators are guaranteed to be in every respect as represented. They are constructed in a strong, simple, durable, and workmanlike manner, and every one is fully tested before leaving the works. They can be easily attached to any boiler. Full directions are sent with every machine by the manufacturer, Wm. E. Kelly, National Iron Works, New Brunswick, N. J.



IMPROVED DAMPER REGULATOR.

Safety in Boilers.—General Dumont, Supervising Inspector of Steamboats, has been making some interesting experiments in testing boiler iron, and thinks that he has nearly arrived at perfection in the safety tests of material to be used in the construction of new boilers. So rigidly have these tests been made and improved upon that out of the eight explosions last year not a single one was a new boiler. Two tests are at present required: First, great tensile strength; and second, great power of extension before breaking. In bars properly made, a bit of iron five inches in length will stretch one-quarter of an inch before giving way. This power of extension, when spread throughout the ponderous plates of a boiler, will give great relief in case of dangerous pressure before an explosion would be possible.

Proposed Grand Turbine Contest.

In testing turbines, the defect thus far has been that the trials have been confined to small wheels, owing to the great expense that would attend the tests of larger sizes. As it is a matter of vast importance that the best plan for turbines should be established beyond chance of doubt, the Holyoke Company has offered for trial, and invites water power companies, cities that pump their water supply, and all others interested in the matter, to take part therein. Each builder shall superintend the setting of his own wheel—the setting and testing to be done at the expense of the Water Power Company. Capacity of each wheel to be sufficient to discharge about 5,000 cubic feet of water per minute, under 18 feet head. Each wheel will be thoroughly tested from half to whole gate, and if deemed best, under at least two different heads; also under several feet of back water. At the conclusion of the trial, a full report will be made of the results obtained, and of the workmanship and probable durability of each kind of wheel tried. Turbine builders of this or any other country are invited to furnish wheels, and those proposing to do so should give notice of such intention as soon as possible. Tests are to commence the first day of September.

The conditions are that right-hand wheels should be sent, as it will save time and trouble in setting, to have all run the same way. The wheels must be complete and the testing flume ready for examination and test on the first day of September. Each wheel must be fitted in a strong frame or platform, 10 inches in thickness, and 6 feet square outside. The opening through the platform for the wheels should be 2 inches in diameter greater than the "draft tube" of the wheel, to allow of a slight lateral movement of the wheel therein, that it may readily be brought under the center of the bearing, for the shaft above. When the wheel is placed in the platform, the hight of the shaft must be exactly 7 feet; 6 inches of the upper end of the shaft must be 4 inches in diameter, having a key seat 1 inch wide and $\frac{3}{8}$ of an inch deep. The top of the stud for opening the gate must be round, projecting 3 inches above its bearing, $1\frac{1}{4}$ inches in diameter, and have an indentation for the point of the set screw $1\frac{1}{4}$ inches from the top of the stud. These dimensions must be carefully observed, that the fits may be free, to allow of quick changes.

The following invitations have been issued by the authorities of Holyoke, Mass.: "The city government, realizing the importance of the above proposition, join with the Water Power Co. in inviting the Locks and Canal Co., of Lowell, Mass., to send Mr. Francis as engineer; the city of Philadelphia to send an engineer familiar with the pumping of water for that city; the National Millers' Association to send an engineer familiar with milling matters; the American Society of Civil Engineers to send an engineer as representative of that society; and the representatives of the owners of the turbines furnished for trial, to select an engineer to care for the interests of turbine builders, the five to be the guests of the city during the trial, to have full charge of the tests, and at the close to report the results in accordance with the proposition of the Water Power Company, to the mayor of the city, in order that the said report may be officially promulgated."

The parties here named have entered wheels for the trial, or have made application for information as to conditions to be observed, etc.: Swain Turbine Co., Lowell, Mass.; Houston Turbine, Fales & Jenks, Pawtucket, R. I.; Wolf, Allentown, Pa.; Victor, Stillwell & Bierce Manufacturing Co., Dayton, Ohio; Hercules, Holyoke Machine Co., Holyoke, Mass.; Henry Vandewater & Co., Auburn, N. Y.; Willis Reed, Danbury, Conn.; E. Dodge, Spencer, N. Y.; Edward Wemple, Fultonville, N. Y.; Joseph Hough, Mechanics Valley, Pa.; Goldie & McCulloch, Gault, Ont.; Humphrey Machine Co, Keene, N. H.; S. Sleeper, Mount Morris, N. Y.; Knowlton & Dolan, Logansport, Ind.; National, Bristol, Conn.; Little Giant, Auburn, N. Y.; T. H. Risdon, Mount Holly, N. J.; Rodney Hunt Machine Co., Orange, Mass.; W. D. King & Co., Pontiac, Mich.; N. F. Burnham, York, Pa.; Wm. F. Perry, Bridgton, Me.

We propose to publish the results of this test in our columns as soon as the report shall have been made by the judges.

Enormous Power Required for Electric Light.

In an article under the above head on page 154 of our July number, in which some data were given from a French paper, we made on its authority some statements which we feel obliged to correct. The total length of streets in Paris was stated to be 550,000 feet, while the actual figure is ten times as great as this. The results are correct, being based on the true length of the streets of Paris, which is 1,600 kilometers, or over 5,000,000 feet. By substituting this exact number the resulting calculation will be found to be correct. Then the amount of horse-power used in Paris and its surroundings, was considerably under-stated, and must be much more than 100,000. However, we gave the statement as we found it, without endorsing it, in order to call the attention of our readers to the conflict of opinions in regard to the comparative economy of modern methods of illumination.

In regard to the experiments lately made in London for illuminating the Thames embankment and the Holborn viaduct, we learn from *Engineering* that a careful estimate of the expense has proved that the cost was the same as that of gas of equal illuminating power, without counting the interest on the expense of the plant of machinery and steam power, and their distribution. When this was added the cost of the electric light was found to be more than double that of gas. We have not space to give the details of the calculation, but will state that it shows that the machinery was very imperfect, the electric carbon lamps or candles of Jablochkoff were very defective, and that there was a most wasteful diffusion and obscuration of the electric light, which, when corrected, would have given far more favorable results. It was the same in the Kensington Museum, which afterward was lighted with eight of Werderman's lamps. The electric generator employed was one of the early and obsolete Gramme machines, driven by a gas engine of 4½ horse-power, and consuming 280 cubic feet of gas per hour. If we reckon the gas at only $2 per 1,000 cubic feet, it amounts to 56 cents per hour, while 4½ horse-power obtained from coal would require 20 pounds of coal per hour at the utmost, which, at $3 per ton, is 3 cents per hour, so that the gas costs almost 20 times as much as coal would have cost. The 8 electric lamps took the place of 30 argand burners, consuming together 140 cubic feet of gas per hour; so that the electric lamps required for their feeding twice the amount of gas sufficient for the gas burners. The English papers, however, are confident that better results would have been obtained if better machinery had been employed, and we think so too.

It surprises us, indeed, that at a time when almost the whole civilized world is looking anxiously for definite and fair tests, in order to settle the important question of the economy of the electric light, our English cousins should risk the reputation of this novel and beautiful application of physical science by using old and obsolete apparatus, and that too in a manner reflecting no credit upon the operators.

On this side of the Atlantic we can really boast of having solved this problem. Its solution has been undertaken in the true manner. Several electricians, all well versed in practical mechanical engineering, and possessing inventive genius, have all in their own peculiar way attempted to produce the maximum of light with the minimum of power and waste, and that they have succeeded, the following article will show. The English and French statistics are on their face unreliable, but we call attention to the more reliable statistics published below in regard to the illumination of the Madison Square Garden by the Fuller electric light, care having been taken to collect the correct data.

Comparative Cost of Electric and Gas Light.

The great question in regard to the real or supposed economy of the electric light is gradually nearing its solution and final settlement. We have examined into the details of the electric illumination of the Madison Square Garden, in this city, which is now lighted up by fourteen electric lamps, furnished with their required electric currents by fourteen Fuller magneto-electric machines, driven by steam power; and the results are as follows:

Formerly this large establishment, of which the size is 400 by 200 feet, required for its illumination over 4,000 gas jets, for which the gas bill amounted to $60 per night. An electric illumination superior to gas was offered them for half that sum, and accepted; it is now in operation, while the profits on this electric illumination are claimed to be two-thirds of the money received, from which it would follow that the cost of this illumination is only $10 per night.

If these figures are correct, it proves one of three things: Either the gas companies make most exorbitant profits, or their mode of making gas is most wretchedly wasteful, or, finally, to obtain from coal the maximum illumination is not to make gas from it, but to burn it in such a way as to obtain the greatest possible heat; to use this heat for raising steam; to use the pressure of this steam to drive a steam engine; to use the power thus obtained to drive machinery developing strong magnetism in iron; to cause this magnetism to induce equally strong electric currents in isolated copper coils; and finally, to lead these electric currents to the place to be illuminated, and discharge them between two carbon points, when, according to the long-known law of electric currents, the mutual neutralization of the positive and negative qualities, results in the development of heat or light, or both, according to the nature of the discharging electrodes.

That this new and scientific way of producing illumination from fuel is not wasteful, but appears to be the most economical of all methods when a strong illumination is required, is one of the most striking illustrations of the modern theory of the conservation of forces, which teaches that heat, light, electricity and magnetism are only various forms of the manifestation of the same fundamental force—molecular motion, and that force is indescructible, and that when apparently disappearing, it only shows itself in another form.

As this matter is of great practical importance, especially in regard to economy, it may be interesting to test the data given and see if they are correct.

The 4,000 gas burners of the Madison Square Garden (which we ourselves counted and examined) are of the size called 1½-foot burners—that is, they burn 1½ cubic feet per hour, (ordinary house burners burn from 3 to 5 feet per hour); this, for 4,000 burners, is 6,000 cubic feet per hour, and for 5 hours—from 7 P.M until midnight—30,000 cubic feet, which, at $2 per 1,000 cubic feet, is $60 per night, which verifies the statement as to the expense for gas.

Let us now compare this with the actual cost of the electric light. The steam engine driving the fourteen magneto-electric machines was stated to exert 60 horse-power, and we had reason to accept this statement, from a measurement of the belt on the main shaft and its velocity, which were such that it could not transmit much more. The coal consumed in a Babcock & Wilcox water tube boiler was half a ton per night of 5 hours, or nearly 3½ pounds per horse-power per hour. The engine is a Porter-Allen engine of 57 rated horse-power, but running at 60, as stated. It runs with 90 pounds pressure, cutting off automatically, and making 280 revolutions per minute, from cylinders 9 by 16 inches. The proportion of the pulleys showed that the light generating electro-magnetic machines made 1,250 revolutions per minute. This makes the consumption of coal 3½ tons per week, which, at $3.50 per ton, is $12.25 for the cost of fuel per week. Two attendants are required, one to take care of the boiler and engine, and one to watch the fourteen machines and lights; the pay of the two men is $33 per week. The consumption of carbons in the candles amounts to about 12 cents per light a night, which, for 14 lamps during 7 nights, is say $11.76. We wish to impress upon the reader that this is absolutely all the direct expense, as there is nothing more than the interest upon the capital invested in machinery, which, with its wear and tear, we will put at 10 per cent. This capital is 14 magneto-electric machines, each costing $400—$5,600; engine and boiler, $3,800; total, $9,400; at 10 per cent interest, makes $940 per year, or a little over $18 per week; so the account stands thus:

Coal for steam boiler	$12 00
Wages for two attendants	33 00
Carbons for lamps	12 00
Interest and wear of machinery	18 00
Total cost per week	$75 00
The gas bill, which was $60 per night, was per week	420 00

Saving per week in favor of electric light, $345 00 or 80 per cent.

But the same attendance, costing say $33 per week, would provide for 100 electric lights as well as 14, and consequently a system of electric illumination on a large scale could be carried on at even greatly reduced figures from those above given.

Such a profit will, in less than one year, pay back the whole of the capital invested, while the wear and tear of the machinery amount to very little with proper care, as there are no parts exposed to much wear; well made steel journals, running with proper lubricants in proper bearings, may be used for years without showing deterioration, as all experienced mechanics know, and it all depends upon the make of the machines, which have already attained a great degree of perfection.

An incidental advantage which we ought to mention, is that a place lit up with such lights is much cooler than when a large number of gas jets are burning, which heat the air, as gas flames in fact produce more heat than light, while the electricity radiates almost nothing but light, producing very little heat. The 4,000 gas flames formerly used in Madison Square Garden always made the place uncomfortably hot in summer, in spite of the precautions for ventilation, while the temperature is now more than 20° Fah. lower than it used to be, or now would be if the electric light had not been substituted.

One gas burner consumes as much oxygen as a single person, and we all know by experience how soon the air in our rooms is vitiated when the gas is lighted. But with the electric light the purity of the atmosphere is preserved and health is promoted, which is one of the most important facts in favor of the general introduction and use of electric lights.

Pumping out the Comstock Mines.—The Sutro Tunnel, built for the reception of water from the Comstock mines, is at last completed after ten years of ceaseless labor day and night, and the expenditure of $6,000,000. The powerful engine of the combination shaft of the Hale and Norcross and the Savage mines was started at precisely 6 o'clock on the morning of June 30, discharging the water into the Sutro Tunnel. It made its appearance in one hour and twenty minutes at the mouth of the tunnel, showing a temperature at first of 101°, which gradually increased to 118 degrees in eight hours. The water in the long drowned out mines was 100 feet. Everything worked well. The wooden boxes, constructed of three-inch tongue and grooved Sierra Nevada pine, did not show a leak. No steam escaped from them, so that the tunnel showed barely an increase of temperature after the hot water was turned on. After all the water finds its way into the tunnel it is expected that one of the double line of boxes will have ample capacity to carry off the water. The success of this great engineering work surpasses all expectations.

Useful Application of Paper.—Paper is now substituted for wood in Germany in the manufacture of lead pencils. It is steeped in an adhesive liquid, and rolled round the core of lead to the required thickness. After drying, it is colored, and resembles an ordinary cedar pencil. The pencils sell in London to retailers at about 65 cents a gross.

Drilling Operations at Hell Gate.

It is well known that the United States government works have been eminently successful in the enlargement of the Hell Gate channel at Hallet's Point. We at the time gave a full description of the same, and will now only remind our readers that the *finale* of a labor of many years was the crushing of three acres of underground rocky river bottom by means of a single explosion of rendrock and giant powder, fired by a galvanic battery. A large portion of the debris fell into the tunnels, and is now low enough down to be out of the way, as the tunnel bottoms were on an average 50 feet below low water mark, while of the remaining pieces of rock, those that are above 26 feet deep below low water, are being removed by dredging.

The great success of this enterprise has been so encouraging that the labor of removing Flood Rock, which lies in the middle of the channel, and toward which some steps had been taken previously, by sinking a shaft, is now being prosecuted with vigor, and in a more thorough manner than at first contemplated. That shaft has been sunk to a depth of 64 feet, and an additional shaft constructed, so that there are now two shafts leading downward, or rather three, as one shaft is double, being divided into two sections, and prepared for a hoist of four times the present capacity. The facilities now employed are inadequate to remove the material taken out of the tunnels below, which, thanks to the use of the air compressors and drills employed in the work, is now quarried out in great quantities. As soon as the new hoisting gear is in operation work will be continued with four times the present results.

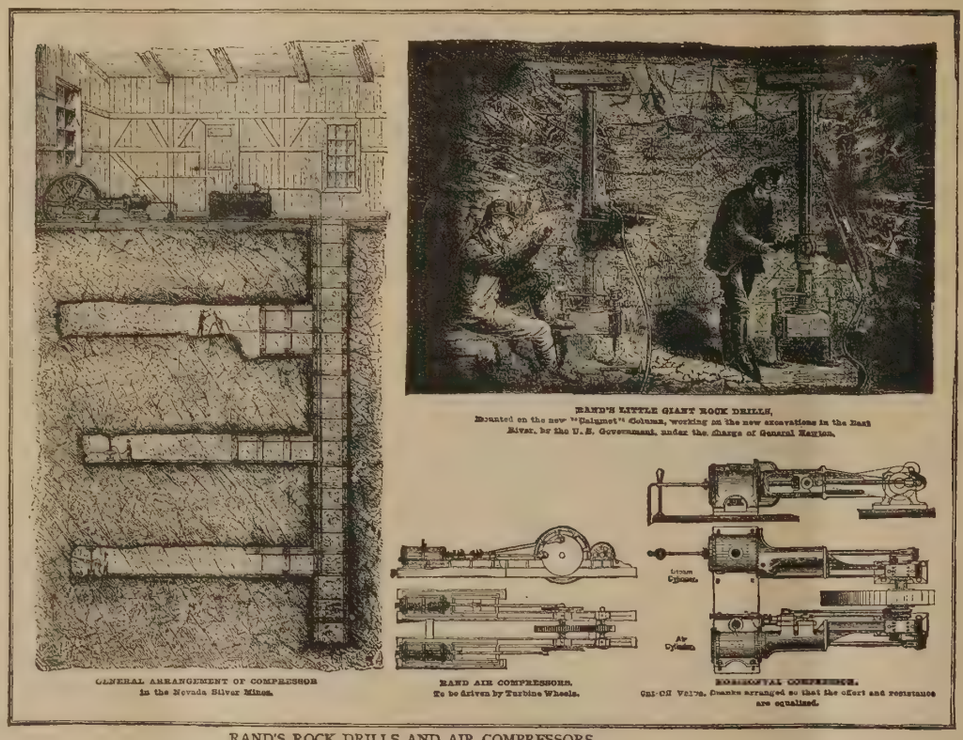
In the adjoined engravings, reduced in size by the photo-engraving process, the figure at the top right-hand corner represents a cross section of one of the tunnels, with the Rand Little Giant rock drills mounted on the new "Calumet" column, at work. The compressed air is led by tubes from the compressors to the place where the drilling is to be done, as represented in the figure at the left, which shows one of the shafts, with side headings, as now in operation at the Nevada silver mines. In all cases the air compressors work outside; the figure shows one in operation above ground, with a large reservoir for the compressed air, intended to equalize the pressure.

It is evident that the air escaping from the operating drills serves to ventilate the mine, cooling it at the same time by the expansion of the compressed air under resistance, the work done by the drill being performed at the cost of the heat of the air used—in fact, the work done is the mechanical equivalent of the heat lost by the compressed air while operating the machine; and this is considerable. It is evident that without this system of drills worked by compressed air, such colossal works as the Hell Gate excavations and the Nevada silver mining operations would be utter impossibilities.

At the lower right-hand corner of our illustration is represented a compressor intended to be driven by a turbine wheel, while a horizontal compressor is also shown.

We have before us an illustrated catalogue of the Rand drills and air compressors, which contains very fine engravings of the various machines used in this line, such as vertical and horizontal compressors of various sizes, air tanks or reservoirs for compressed air, drills mounted on tripods and on columns, mounted for the special purpose of quarrying, etc., while a separate engraving shows all the different parts of an improved rock drill.

We advise all interested to apply for this catalogue at the office of the company, 21 Park Row, New York.


RAND'S LITTLE GIANT ROCK DRILLS,
Mounted on the new "Calumet" Column, working at the new excavations in the Hell Gate, for the U. S. Government, under the charge of General Newton.
GENERAL ARRANGEMENT OF COMPRESSOR in the Nevada Silver Mines.
RAND AIR COMPRESSORS. To be driven by Turbine Wheels.
HORIZONTAL COMPRESSOR.

RAND'S ROCK DRILLS AND AIR COMPRESSORS.

Our Great Iron Piers.

The iron piers which have been erected at the two great watering places now competing for public favor — Coney Island and Long Branch — are completed. the Coney Island pier was begun later but is the first ready; it is 1,000 feet long and 50 wide, with enlargements at both ends and at the middle of 100 feet or more. It is two stories high, the top story being roofed over, and surpasses the famous piers in England at Scarborough and Douglas, which are also 1,000 feet long, but not half as wide, the Douglas pier being only one-third as wide, while the celebrated Westward Ho! pier is only half as long. The Coney Island pier stands upon 260 hollow iron piles, driven 20 feet deep in the sand, and thoroughly braced. The landings are made on the lower story, 12 feet above the water level; this story contains the bathing houses, with steps leading into the water; other steps lead to the upper story, which is bordered with restaurants, pavilions, offices, etc., while towers project above the roof, giving the whole a charming appearance. Gas is used to illuminate the interior, while electric lights illuminate the water around in the evening. The depth of the water at the end is from 15 to 20 feet, according to the tide, so that the largest steamers used here for inland and coastwise passenger traffic always find plenty of water. The pier was commenced on the 22d of April and ready for use in 9 weeks, costing $200,000.

The Long Branch pier is about 850 feet long, with a depth of 22 feet at the end at low water, the shore being steeper than at Coney Island. The iron piles are tubular, and near the shore 6 inches in diameter, increasing in size as they advance toward the end, where the piles are some 50 feet long and 12 inches in diameter. This pier is 25 feet wide, with expansions of 50 feet. The floors and other wood-work are of ash, which, during the winter season, when the Jersey coast is very stormy, are to be broken up and removed, to allow the waves to break over the iron without damage. On both sides of the pier along the shore are pavilions for promenades, balconies, restaurants, etc., while under it are 600 bathing rooms, supplied with gas and running water. On both sides of the pier there are bathing grounds.

The Great Mexican Railroad.

One of the most colossal modern engineering enterprises has been the construction of the great railroad from Vera Cruz to the City of Mexico. It passes through one of the most picturesque countries in the world, and, traversing the mountain chain of the great Sierra, offers the finest views imaginable. The road is 268 miles long, passes through 18 tunnels, and over several magnificent iron bridges; it has cost $40,000,000, and is considered to be the finest and best constructed railway on the whole American continent.

The first 40 miles from Vera Cruz are straight, with a gradual slight ascent from the sea level; then for a distance of 75 miles it traverses three distinct mountain ranges, each of which looks like a colossal wall. This section of the road runs through many cañons, winds along the sides of mountains over precipices, sometimes perpendicular and of a depth of 3,000 feet. The average grade is here 400 feet per mile, and the ordinary American locomotives had the greatest difficulty to ascend them, so that the company had special locomotives constructed in England under the Fairlies patent, which are said to be able to pull ten cars. They are double engines, or two steam engines combined, with driving wheels of 30 inches.

At the western end of this division, near Boca del Monte, the greatest hight is attained, being 13,000 feet above the sea level at Vera Cruz. Then the road gradually descends over a series of hills and valleys, until the City of Mexico is reached, which is still 8,000 feet above the sea level. The valleys through which the road passes are from 3 to 20 miles wide, bounded by steep mountains. Every part of this region is now under a high state of cultivation, and artificially irrigated in the best manner.

PLOWING BY ELECTRICITY.—At a recent meeting of the Paris Academy of Sciences, M. Tresca gave an account of some experiments in plowing by electricity which he witnessed at Sermaise, in the Marne. A Gramme machine, making 1,200 revolutions per minute, and driven by a steam engine, was connected to a second Gramme at a distance of 440 yards, and caused the latter to revolve at the rate of 1,140 revolutions per minute, the electricity produced by the first machine being thus converted into work. The second machine was connected to a third at a distance of 219 yards, and these two worked cables attached to a double Brabant plow. According to M. Tresca, the experiment was very successful, the work accomplished representing the equivalent of three horse-power, while one-half of the motive power obtained from the steam engine was really transferred to a distance of more than 1,000 yards from the furnace.

Modern Saw Mill Machinery.

Any one who has seen an ordinary saw mill driven by steam or water power, is aware that it consists of two separate sets of machinery, one to furnish the power and the other set to do the work, while belting or gearing connects the two. In building such a saw mill it used to be the custom to engage a master millwright to design the machinery; after it had been approved off, it was built to order at a machine-shop, and when ready, transported to the mill to be put up and the parts properly connected. Modern improvements have changed all this; parties desiring to have a saw mill can now buy it all in one piece ready made, and all they have to do is to place it in a building capable of sheltering it, or otherwise constructing a shed over it.

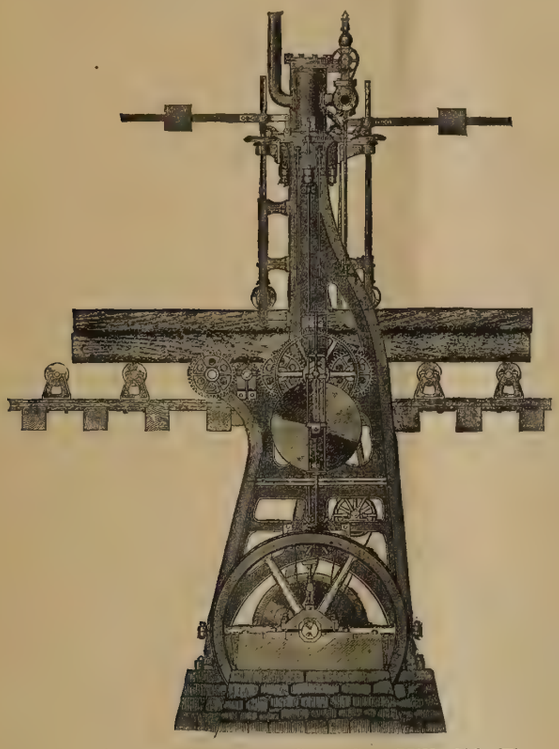


Fig. 1.—Direct-Acting Steam Gang Saw Mill—Side View.

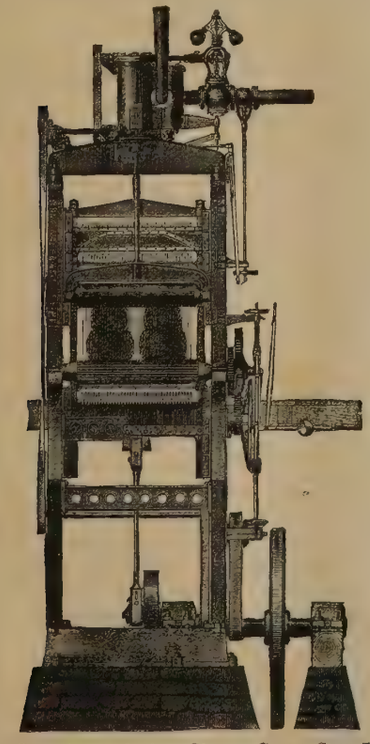


Fig. 2.—Direct-Acting Steam Gang Saw Mill—Front View.

The adjoined engravings represent saw mills of this description, manufactured by Snyder Brothers, of Williamsport, Pa. This firm have for a long time made the manufacture of different varieties of saw mill machinery a specialty, including machinery for the manufacture of shingles and various special forms of lumber; but at last, seeing the increasing importance of the ordinary saw mill for cutting plain lumber, and the desirability of making these mills more solid, massive, reliable, and capable of turning out work of better quality and in larger quantity, they devised the mill shown in Figs. 1 and 2, which they call their Patent Direct-Acting Steam Gang Saw Mill. It is built as a round gang, a saddle slabber, or flat gang, as desired. It is constructed entirely of metal, resting on a massive cast-iron bed plate, and is self-acting in every way. The steam cylinder is directly over, and the piston rod attached directly to the saw frame.

Fig. 1 represents an elevation taken across the lumber under operation, while Fig. 2 represents an elevation longitudinal to the lumber. It will be seen that the whole machine rests on stone-work, or on piles, while on the story above the sawyer attends to the performance of the work, and stands at one side of the machine, controlling the motion of the saws and feed, and raising and lowering the rolls merely by touching small handles within easy reach from the point where he stands. The great strength and solidity of this machine render it capable of turning out a much greater quantity of lumber, and of a better finish, than that made on a common gang.

Figs. 3 and 4 represent another arrangement similar to the one described, but in which, instead of a direct-acting steam engine under the saws, the same are moved by a belt from a separate steam engine. From the bed rise heavy upright frames, secured by cross-pieces, as in Figs. 1 and 2. One cross-piece, as well as side frame, are represented as partly removed, in order to show the lower girt of the saw frame. The log is carried on iron trucks, and the sawed end is held by a clamp. The iron trucks carrying the log run on rails secured to the floor of the mill. As represented here, they possess an improved intermittent silent feed, but if ordered otherwise, with a rotary, continuous or ratchet jab feed, they are made as desired.

The frame is connected at its lower end by a connecting rod, called a "pitman," to the wheel crank on the shaft, on which is a pulley and fly-wheel. By this mechanism the saw gate, or frame, has a reciprocating motion imparted to it. On each side of the frame are rollers with teeth, called "spike rollers," which are made to revolve by gearing on their ends, and feed the log up to the saws. The front end of the log is placed on the roller, and the other end is supported on a truck, called a "bear trap," and held in place by two arms, furnished with long teeth, which are forced into the log, holding it firmly. The truck has flanged wheels, running upon an iron track. When the log is partially sawed, and the end now being sawed into boards or plank, the truck, called a "clamp," is now run under it; on this truck are two upright jaws, geared to a right and left screw, by which the arms are forced up against the sawed log, and pinch it lightly. The pressure of the pressure rolls, called "binders," is regulated by levers and adjustable weights. The feed is driven and regulated, first, by the eccentric on the crank shaft, and connects with the rocker arms, which rock on the center. One rock arm is round, and on it slides a box, connected at its upper end to a rocker. By this combination the rock arm is made to vibrate to a greater or less degree, as the block is moved on the arm by the lever. The feed wheel, called "rag wheel," has a V turned into its outer edge, and at the outer end of the arm is a V shaped cam or "dog," which fits into this V groove. When the rock arm moves down, this dog moves loosely along in a groove, at the same time the frame, with its saws, are moving up; when the rock arm moves up the dog is forced into the V in the wheel, carrying it around, and, by suitable gearing, turning the rolls and feeding the log forward, as the frame and its saws are moving down and doing the cutting. This is what

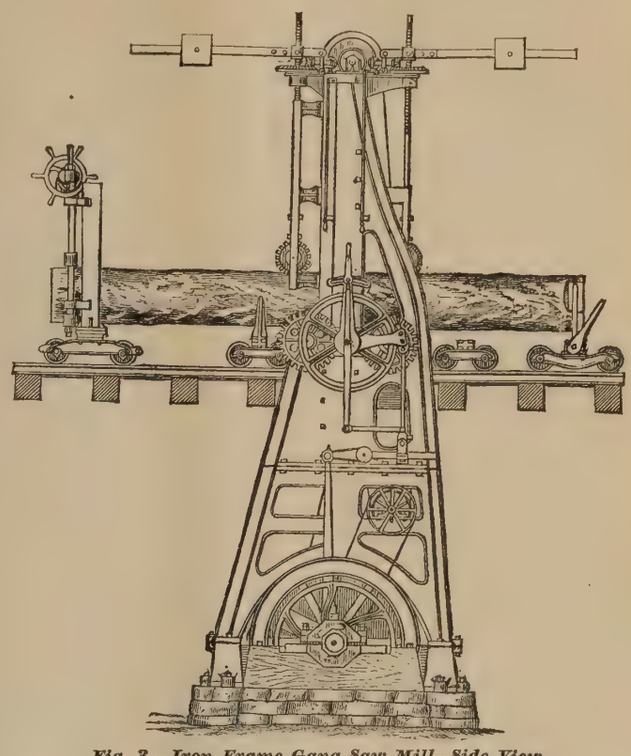


Fig. 3.—Iron Frame Gang Saw Mill—Side View.

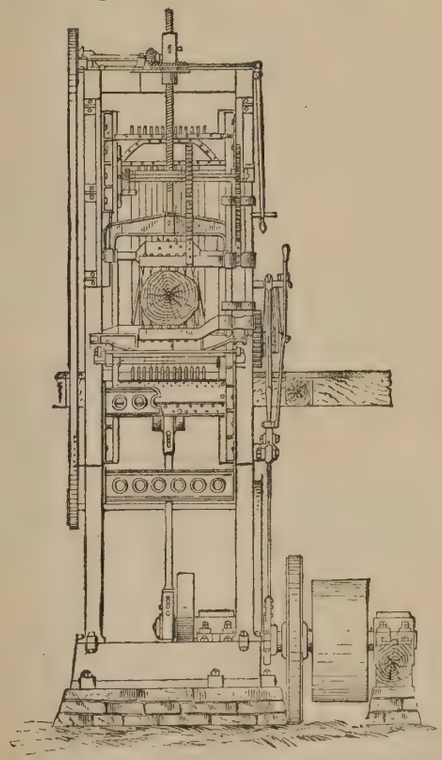


Fig. 4.—Iron Frame Gang Saw Mill—Front View.

is known as a friction jab feed. Some gangs are built with a continuous feed; in that case the saws must be over-hung, so as to clear the wood while it is moving upward.

Snyder Brothers have also special facilities for the making of all sizes of pulleys, both light and heavy, either split or solid, of all the even sizes, and many odd sizes, and of any desired width of face up to 12 feet in diameter; gear wheels, hangers, boxes, flanges, etc., in great variety; Fritze's patent shaft couplings, and common flange couplings; iron spool jacking machines of various styles. In fact they build everything required for a complete saw mill, and will be pleased to furnish estimates of machinery, either delivered at their works, or boxed and ready for shipment by sea from Philadelphia or New York. They have special facilities to offer those desiring new styles of machinery, or wish to try experiments, as they have competent draughtsmen, pattern makers, trained machinists, and the best of machinery, and are willing to undertake any jobs within the compass of their works.

Building Intelligence.

New York City Building Items.

Mr. Lucius Tuckerman is erecting on the east side of Washington Square, just south of the old church which stands upon the corner of Washington place, a six-story brick building which is to be an apartment-house for bachelors. It has been Mr. Tuckerman's purpose to supply comfortable, and even luxurious, homes for single men, in suites of rooms fitted up with all the elegance and completeness of appointment of a first-class hotel, at a price little higher than is commonly paid for a single meanly-furnished room in a private house. This design is being carried out in a way that has already assured the success of the enterprise, lifted it above the plane of mere experiment, and will doubtless lead to its imitation in other localities. With a frontage of about 40 feet on University place and a hight of about six stories, the building is conspicuous by reason of its dimensions. It is still more noticeable for its material and architectural treatment. The front is of Philadelphia brick. A thick, projecting layer of Nova Scotia stone marks the level of the different stories. Molded brick has been used to form the projecting window-caps and jambs and for the corners of the piers, which stand out from the surface of the building. The plan provides for two stores on the ground floor, with an arched entrance and vestibule between them. From the stores to the sixth story a line of broad bay windows stretches up on each side. A balcony of Nova Scotia stone, supported by carved brackets of the same material, has been placed under the windows of the third story, in the middle of the building over the arch, and tiles have been sparingly used about the windows. Another balcony runs across the entire front at the level of the windows of the upper story. There is to be some handsome brick carving upon the spandrel of the arch which forms the entrance, and elsewhere about the lower story. The front, as a whole, will be very pleasing to the eye. It is agreeably broken by the bay-windows, the lines of construction are indicated by the layers of stone, and it is not loaded with "gingerbread" work. The building is to be fire-proof, being entirely of stone, brick and iron, with floors of fire-proof filling between the girders. The quadrangular contour of the ground plan is broken on the north and south sides by courts, giving the building the shape of the letter I. This plan gives windows on two sides to all the more important rooms, and lights and ventilates the whole central portion of each story. Upon the first floor will be the two stores in front, as mentioned above, two suites of apartments, consisting of parlor and bed room, occupying the rear corners, a single apartment between, a roomy vestibule, and the janitor's rooms. The second, third, fourth and fifth floors each have seven suites of apartments, and upon the sixth floor there are four studios, with a north light and two suites of rooms. The rooms of all the stories are similar in size and plan. The suites of apartments consist of a parlor 16 by 18 feet, a bedroom 13 by 15 feet, two large closets—sometimes three—and, in most cases, include a private bath. The parlors at the front of the building overlook the square, with its trees and fountain, through the four windows which make up the great bay-windows, and have, also, windows at the sides, while the adjoining bedrooms have windows opening upon the court and upon the sides of the building. The single rooms are as large as the parlors of the double suites, amply lighted and ventilated, and in some cases have an alcove for the bed. Descending to the ground floor, we find the janitor's kitchen and dining room, the laundry, coal cellars and the boiler-room. The interior finish of the building and its rooms is to be of an elegance in keeping with its character. The floor of the vestibule will be laid in encaustic tiles, and the walls in pattern brick. The doors opening upon the vestibule will be of ash, thick and solid, admitting of deep panels. The apartments will be finished in natural woods, the first, second and third stories in ash, the upper stories in pine, oiled and shellacked. The floors will be of Georgia pine, laid in narrow stripes, and will not be put down until all the other work is done, so that their polished surfaces will not be marred by the masons and plasterers. The advantages to be enjoyed in common by all the occupants are similar to those of a first-class hotel. There is an elevator in the center of the building, and a freight-lift on the other side of the vestibule for hoisting trunks and all heavy articles.

D. & J. Jardine are the architects of four first-class houses in the fashionable part of the city: For Mr. Adolphe Bernheimer they are planning a fire-proof house, twenty-seven feet six inches by one hundred feet, at No. 7 East Fifty-seventh street. It will have a Portland stone front, and will cost about forty thousand dollars. For Mr. Arthur B. Graves, president of the St. Nicholas Bank, they will build a brick house on Fifty-fifth street, between Madison and Fifth Avenues, twenty-seven by eighty-five feet, in Queen Anne style. For Mr. Griffith Rowe, on Fifth Avenue, corner of Fifty-fourth street, a brick house, with stone finish, twenty-eight feet six inches by one hundred feet, four stories, with iron mansard roof. For Ezra White, at No. 7 East Fifty-sixth street, a stone front house has been contracted out to O'Reilly Brothers, at figures approximating thirty thousand dollars.

The old Protestant Episcopal Church edifice at Lafayette place and Great Jones street has been torn down and on its site will be erected a seven-story building by Father Drumgoole, of the St. Vincent de Paul's Home for Boys, who will transfer to it his mission now at 53 Warren street.

Jas. E. Ware, who was awarded the prize for his design for a model tenement-house, is to build two on the adjacent lots Nos. 758 and 760 Second Avenue. The designs are similar to those for which he obtained the premium. The cost is estimated at about $11,000 each.

Levi P. Morton has plans drawn by J. W. Marshall for twenty houses on One Hundred and Nineteenth street, between Madison and Fifth Avenues. Six are to be 16 by 50 feet and the remainder 16 by 45 feet. They are to be of brown stone, and will cost about $4,000.

About twenty thousand dollars, it is reported, are to be spent in the alterations to the Broadway Theater, just started, by Mr. S. D. Hatch, architect. The alterations will be principally in the entrance and interior arrangements.

The Gibson building, occupied in part by Wallack's Theater, corner of Broadway and Thirteenth street, having reverted to the Astors, is being improved and altered under the superintendence of Thomas Stent, architect.

Jas. E. Ware is building, for Benj. Johnson, on the corner of King and McDougall streets, an apartment-house covering two lots, the building to be of brick, with stone finish; cost, about $27,000.

A handsome residence for F. F. Thompson is to be built at 289 Madison Avenue by McKim, Mead & Bigelow, architects. It will be of Philadelphia face-brick, with stone finish.

The building Nos. 19 and 21 Nassau street, is being raised one story. Extensive interior improvements, including elevator, will cost twenty thousand dollars.

S. A. Warner is the architect for a substantial brown stone and brick house to be erected for Albert Kelly on Fifty-third street, at a cost of $30,000.

Mr. Edward H. Kendall has lately completed plans for the new depots on the Second Avenue branch of the Metropolitan Elevated Road.

Miscellaneous.

Cornelius J. Vanderbilt has bought an estate at West Hartford, Conn., and will build upon it a handsome house.

At Cincinnati, O., the Wiggins building is being erected on the southeast corner of Vine and Fifth streets, and will cost $70,000. J. W. McLaughlin is the architect. It is to be six stories high, and on each side of the upper floors there will be ten rooms for offices.

C. P. Libby is erecting in Chicago, Ill., on the corner of Michigan Avenue and Thirty-fourth street, a three-story villa in the French renaissance style, built of Marquette brown sand stone, the inside to be finished in hard wood. The cost of this improvement will be about $40,000.

L. Z. Leiter of Chicago, has purchased the piece of ground at the northwest corner of Fifth avenue and Monroe street, in that city, upon which he intends to build at once a first-class five-story store 80 by 103 feet. The cost of the building together with the land will be in the neighborhood of $125,000.

In Boston, Mass., a six-story stone building, designed for stores and offices, covering about 13,000 square feet of land, and occupying the center of Liberty Square, surrounded by streets, will be built the coming season from designs prepared by Wm. G. Preston, architect. The owner is William Mason, of Taunton. The cost will be about $200,000.

The proprietors of Fleischmann's Vienna Model Bakery in Philadelphia intend to commence immediately the erection of a new and handsome building expressly for their business, on Broad street, below Vine. It will be completed by the 1st of October next. It will have a frontage of 85 feet on Broad street, will be 125 feet deep and three stories high, and will contain the latest and most improved machinery and every appliance that can facilitate the production of bread, rolls and Zwieback, including 8 immense ovens. It will be the largest and best equipped bakery in Philadelphia.

At a meeting last month of the Board of Trustees of Vassar College at Poughkeepsie, N. Y., it was decided that a separate building for the chemical laboratory should be constructed. Matthew Vassar, Jr., has promised to pay the whole cost of the building, estimated at about $25,000. He has also agreed to have the new laboratory ready for occupation by the beginning of the next academic year, in September. A bronze statue of the founder of the institution is also proposed. A model has been made in plaster, and is now on exhibition in the board-room. When mounted on its pedestal it is to be seventeen feet high and is to stand in the "circle" just in front of the central entrance to the college building. Its cost is estimated at from $8,000 to $10,000.

The new House of Refuge at Rochester, N. Y., will be begun at once and is to be finished by January 1st. The contract calls for heating the structure throughout by steam, supplying it with first-class plumbing work, bathing tubs of the most approved pattern, wash basins with marble tops, and to be lighted with gas. It is to be of brick with stone trimmings and slate roof. The contract has been awarded to George H. Thompson & Co., for $30,945. This new addition is intended to be used solely for girls not over 12 years of age. The architects are Warner & Brockett. The new kitchen building has been planned by Charles Coots and the contract has been awarded to the same contractors at $11,566.

Hoisting by Hot Air.

The idea of applying the modern improved caloric engine for hoisting purposes is an excellent one, and has recently been put into execution by the Sherrill Roper Air Engine Co., of 91 Washington street, New York. There are hundreds of localities where hoist-ways worked by hand are in use, but where the amount of material to be hoisted daily is rather too great for hand power, and where the owners are reluctant to go to the expense and trouble of supplying steam power, with its unavoidable drawbacks of boilers and an engineer to take care of them and of the steam engine. Fortunately there exists an engine equivalent to the steam engine, dispensing with boilers as well as with steam engineers, also fully capable of doing this duty, and ready for work much sooner than a steam engine, which requires the raising of steam of a certain pressure before it can be started. This is the Roper hot-air engine, already favorably known for some years, and introduced among manufacturers for various other kinds of work. This engine is now found to be admirably adapted to meet the wants of all who have more materials to hoist to upper lofts, or from cellars and vaults, than can conveniently be done by hand labor.

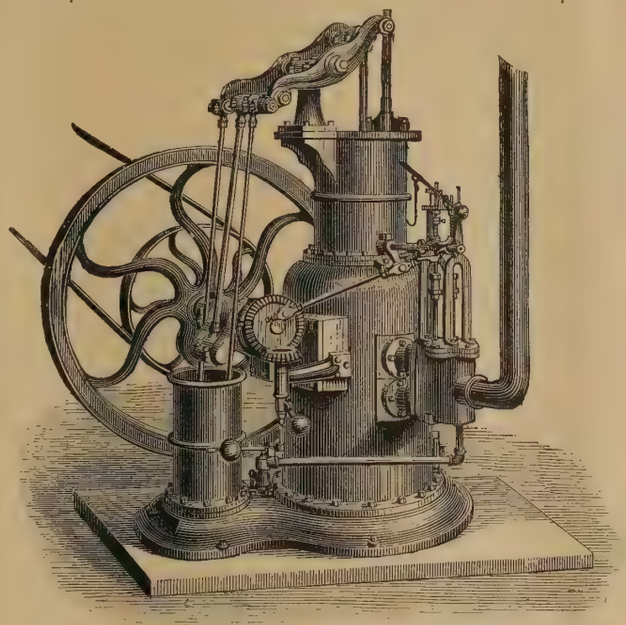


Fig. 1.—The Roper Caloric Engine.

The engine is represented in Fig. 1, while the large engraving (Fig. 2) represents its mode of application to an elevator, which may be made to move upward as well as downward from the floor on which the engine stands, so that the latter can as well be placed on the top floor of a building as in the cellar below or the vault under the street.

It is scarcely necessary to enumerate all the advantages gained by this application, and we will only mention such points as are comparatively unknown. In the improved Roper engine (Fig. 1) the fuel and air are employed in a way that insures the most perfect economy of the former and greatest expansion of the latter. The air at the temperature of the surrounding atmosphere is drawn into the air pump and then forced directly into the fire, which burns in an air-tight furnace; combustion and expansion ensue, and as a result of the expansion of the air and gases produced by combustion, a pressure is obtained in the fire box, which is admitted to the cylinder and exhausted through valves, as a steam pressure would operate. The furnace is lined with heavy fire brick, and as the air is brought in contact with the *fire*, and not hot iron plates, there are no heating surfaces to be destroyed by use.

The mechanical construction is as good as the best of material and workmanship can produce, and we are confident that this compact, simple, upright engine will commend itself to any mechanic or other person who will give it attention. During the past few years a number of small steam engines have been put upon the market, and from their low price are attractive to purchasers; but however small it may be, or however skillfully made, the fact remains that a steam boiler requires the constant attention of an experienced man, and, as shown by frequent explosions, is dangerous under the most favorable circumstances. Any inexperienced person can, with a few instructions, take care of one of these hot-air engines as well as an engineer, and in such a short time that his other duties would scarcely be interfered with. The wages of an engineer is a large item where a small amount of power is used, and is in many cases more than the power is actually worth. When this sum is added to the amount saved in fuel and insurance, the result will show that a Roper engine will pay for itself in a very short time, while the satisfaction of having power which is in any case absolutely safe is a point not to be overlooked. No water being used, either to make steam or condensed air, the trouble and expense of keeping pipes in order is avoided, and there is no moisture about the engine to cause rust when not in use. The exhaust air can be conducted away in pipes, and used to warm rooms, heat japanning ovens, or for other industrial uses. For any purpose requiring power within the amounts furnished by these engines, we state, as proven by the experience of many, that they will in almost every instance effect a saving in one or two years sufficient to pay for them.

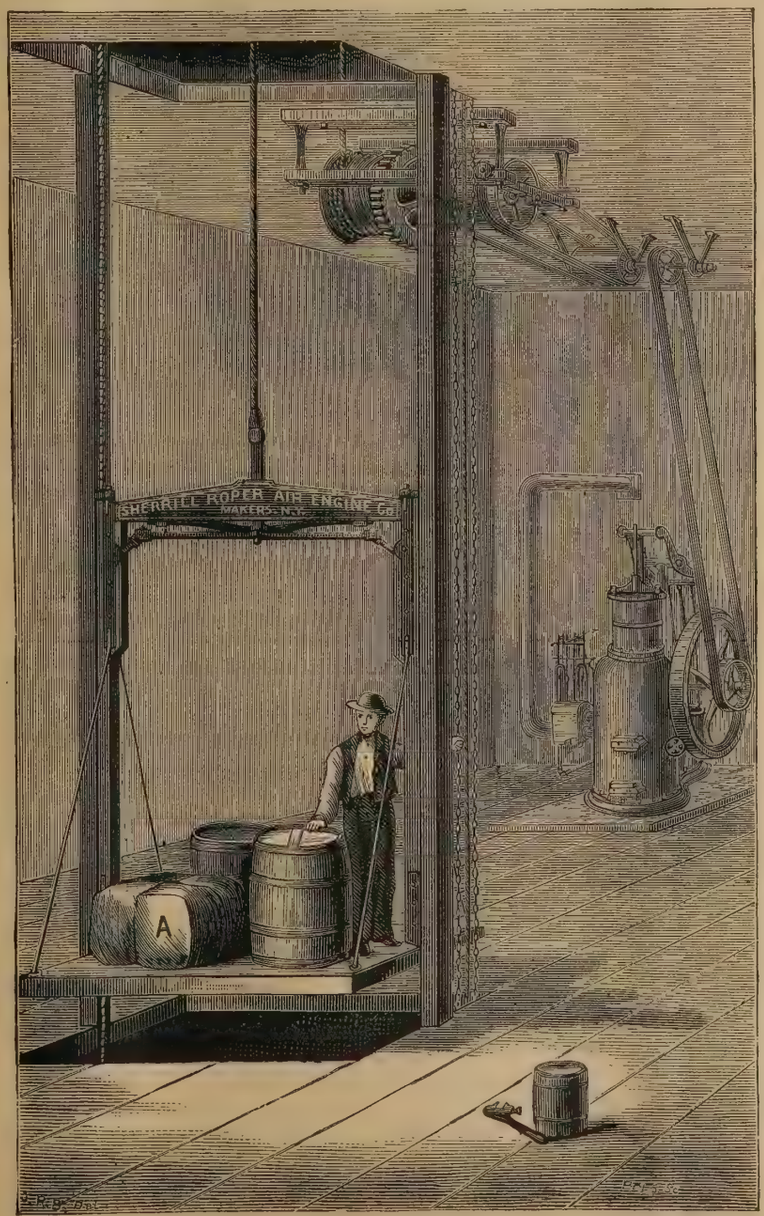


Fig. 2.—Application of the Caloric Engine for Hoisting.

Increase of Our Trade Abroad.

Ten years ago the only distant localities where machine-made joinery was sent, was to the West, especially Colorado and California, to which States doors, sashes and blinds were sent by the car-load. Within the last two years an exportation to Europe has begun. The first shipment was to England, in 1877, it was chiefly cheap doors, of which 19,000 were sent, and some 6,000 pairs of sashes and blinds; the greater part of these went thence to Australia and New Zealand. Since then California has supplied machine-made joinery to Australia, sending there 27,000 doors last month as against some 5,000 sent direct from New York. But the transfer of the Australian demand for machine-made doors to California, and its consequent loss to the Eastern States, has been compensated for by an increase in the British demand for local use. The shipments of doors to England and Scotland in 1878 were about 45,000, as against 2,800 in 1877. Up to June of the present year these shipments show a slight increase. It is a trade that is evidently capable of great extension, for all the pine lumber used in England is brought from Norway and the United States. It is a trade, too, that affects the English workman in two ways. For many years past there has been a large annual demand upon England from Australia and other British dependencies where wood of the proper kind for the doors of warehouses and private dwellings is scarce, and to economize the cost of the doors so exported, they were made up into packing boxes, four doors placed longitudinally forming each box, the two ends being doors for small closets. As all the doors were hand made, the trade of making them gave employment to quite a large number of English workmen, and the diversion of this trade to California, coupled

with the demand that has sprung up in England itself for the machine-made doors of the United States, causes a good deal of anxiety among English joiners and carpenters, in the present depressed condition of business there.

Atomized Petroleum as Fuel.

According to newspaper reports it appears that the use of petroleum as a fuel for steam boilers is at last a decided success. Exhibitions of the peculiar effects of the improved arrangements have been given in Pittsburgh, Pa., and the results are highly favorable. As far as we can understand from the description, there is nothing especially new in the process. A spray of petroleum and a blast of air, both projected by steam into the furnace, produce a roaring flame, and when once started, keep the fire going; but some minor improvements, intended to keep the quantities of the three substances named in proper proportion, so as to produce the maximum heat, appear to be the peculiar improvements which made this long-sought process successful.

The report states that the little steamer "Billy Collins" was selected for the test, and was fired up; a preliminary blaze of wood under the boiler raised the small quantity of steam necessary to start the burner into operation. The oil valve was opened a trifle, as was also the steam valve. The petroleum trickled into the feed pipe, was caught up by the steam, and both plunged into the depths of the fire box, a mass of many-tongued, roaring, brilliant flame. As the pressure of steam increased, this flame grew in fury and intense heat, roaring through the entire length of the boiler with a sound like the coming of a thunder-storm. The needle of the steam gauge climbed rapidly up the dial, and in twenty minutes the safety valve blew off at 120 pounds pressure. It was a remarkable sight; here was a boat puffing through the water with no sign of smoke from her chimneys, no speck of soot in flues or fire box, no fireman, no opening of furnace doors, no dirt, no coal going in, and no clinkers or ashes to be seen anywhere! A turn of the hand regulated the roaring flame that seemed trying to overpower the limits of the furnace, and another turn of the hand brought the fire down to a quiet little flame, a foot or two long. During the time occupied by the test about 20 gallons of crude oil were consumed, and the estimate was, that with oil at $1 per barrel, this fuel was equivalent to coal at 6 cents in heat-producing value, other things being equal.

But other things are not equal by any means, and everything is in favor of oil as against coal. The labor and expense of firing up is dispensed with, and the engineer can regulate the flame as he does the steam in his engine. The danger from sparks and flying cinders is entirely done away with. The space occupied by oil, as compared to an equal value of coal, is very much less, and this much is gained in freight. Further, the wear and tear upon boilers, grate bars, etc., is infinitely less, and, it seems scarcely necessary to add, the comfort of passengers is greatly enhanced by the absolute freedom from dirt of all kinds.

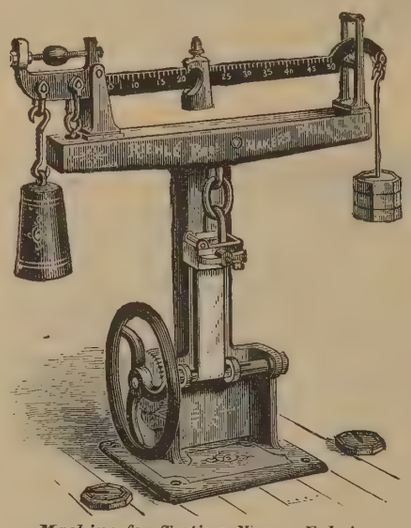
This method of producing steam is full of interest to steamboat owners; here is a fuel that seems provided by nature especially for use on craft where every inch of carrying space is valuable. To ocean-going steamers this device must prove of extraordinary interest. A tank of oil situated at a remote end of the ship would hold fuel sufficient for a double trip, and supplant the great coal bunkers with their attendant dirt. Space prevents even a glance at the possibilities of this burner on the ocean.

To railroad men this burner is full of promise also. A locomotive boiler, with its many tubes, would be pierced in every part with this wonderful oil flame, and the benefits arising from the entire absence of sparks, cinders and smoke, are simply incalculable.

The oil producers are overjoyed at the prospect that in this way there may come some relief for the overproduction of petroleum, of which there are now 200,000,000 gallons more above ground than there should be. This over-stock has depressed the price to 64 cents a barrel, at which it is going a-begging. Every hour adds to this already too large stock of oil, and in spite of all consumption and destruction by occasional oil fires, it is constantly accumulating. In the oil regions alone there are now on hand 7,000,000 barrels of 40 gallons each.

Machine for Testing Woven Fabrics.

Riehlé Bros., scale makers, of Philadelphia, have introduced a machine intended to test the strength of cloth, cotton and other woven goods. It is represented in the adjoined engraving, and intended to furnish merchants with a ready means for testing and comparing the grade of goods in regard to their tensile strength. The machine has regular scale levers, which are enclosed in the upper part of the frame, and are connected to a brass beam, graduated from ½ pound up to 500 pounds, the latter figure representing the capacity of the machine. The samples of cloth, cotton, paper, or whatever is to be tested is inserted in a clamp attached to the weighing mechanism. This clamp, which is lined with leather to avoid cutting the goods, is so constructed that it must adjust itself and give a perfectly straight pull on the specimen. The other end of the sample is then wrapped around a roller and the strain put on by turning a hand wheel. The beam must be kept in equipoise by moving the running weight, and the operation be continued until the sample breaks, the result of the test being then registered on the beam in pounds. This apparatus is all made of iron, with steel bearings, and takes up little room; it can be fixed on desk or counter, and is always ready for immediate use. It will admit samples of goods 3 inches wide and 8 inches long.



Machine for Testing Woven Fabrics.

This machine was made at the suggestion of Mr. Wm. Simpson, Jr., of the Eddystone Manufacturing Co., of Chester, Pa., and was patented November 25th, 1878.

Belting in the United States vs. Gearing in Europe.

Prof. Radinger, well known as a great German theoretical mechanic, has published, in his report relative to the Centennial Exhibition in Philadelphia, an article on the "Transmission of motion by Belting," of which we give here an abridged translation:

"In Europe the use of belting for the transmission of considerable power has been discarded, because, according to calculations, the necessary tension of the belts produces a great increase in axial friction, which is not the case with gearing. In the latter we have an axial pressure, balancing and therefore equal to the pressure on the teeth, while when using belts this axial pressure is three times as large. This estimate is based on the correct principle that the power transmitted by the belt is measured by the difference in the tension of the two halves of the belt, namely, the greater tension of that part of the belt leaving the driving pulley and the lesser tension of that part which is approaching the same. Experiments have led to a formula in which this is expressed, and also that as long as no slipping takes place, the smaller tension, when half the pulley is embraced by the belt, is about half that of the greater tension. From this was deduced the conclusion that if the driving belt pulls the pulley with one part equal to the power, and with the other part equal to twice the power, the sum of these two pulls on the axis, or the axial pressure, must be equal to thrice the power.

"In the United States, however, it was found that atmospheric pressure also keeps the belt against the pulleys. During the gradual advance which the driving pulley obtains over the belt, the air is pressed out between the pulley and the belt, and the belt lays so close to the pulley that it almost sticks to it, so that even by a very diminished and scarcely measurable tension, sufficient power is still transmitted, if the belt only touches the pulley over a sufficiently large surface. In order to accomplish this the belt must lie fully and uniformly on the pulley, it must be without defects, and have uniform tension, also, besides all this, the pulley must be carefully balanced, so that its motion is uniform.

"Seen from this new point of view, the objection of the waste of power by the use of belts falls to the ground, and this has induced manufacturers in the United States, since 1840, to acknowledge the advantages of belting over gearing, and to use the former almost exclusively, even for the transmission of the greatest power.

"In order to secure the close contact of the belt with the pulley, the custom in the United States is to put the more dense hair side on the pulley, and not the more rough and softer flesh side.

"In regard to the necessary dimensions for the transmisssion of power, Radinger deduces from the American method or custom the following formula in millimeters:

$$b = \text{from } 2\frac{P}{D} \text{ until } 2\tfrac{1}{2}\frac{P}{D}$$

in which b represents the width of the belt, P the pull on the belt in kilograms, and D the diameter of the small pulley in meters. It is further accepted in the United States that a belt can carry with certainty 1.8 kilogram for every millimeter of its width; commonly however smaller amounts are carried, (0.3 to 0.8 kilogram, which number however grows with the size of the machine). The mean velocity of belts is from 13 to 15 meters per second, while the highest in use is 30 meters (about 100 feet) per second.

"Rubber belting is, according to American experience, just as good as leather; it is cheaper than leather, and lasts at least as long, provided it is run on proper pulley surfaces. It stands moisture better than leather, but does not stand shifting from a working to an idle pulley as well.

"The dimensions of American leather and rubber belts are often gigantic; double leather belts of 1 meter (3 feet 4 inches) wide, 40 to 50 meters (140 to 160 feet) long, and 15 millimeters (⅝ of an inch) thick, are nothing extraordinary." Radinger even saw a belt of 1.52 meters (5½ feet) wide and 190 meters (300 feet) long; other belts were even 190 meters (630 feet) long.

This article of Prof. Radinger has been criticised by Doctor I. Schlink, who points out that the idea of the great loss of power by belts, by increased axial friction, was abandoned on the European continent years ago, and that though England may have been tardy in acknowledging it, in Germany experience has shown the advantage of belting. He points out the existence of a series of rolling mills in the Rhine provinces and Westphalia, where considerable power (150 horse) is successfully transmitted by belting, which often has to do more work than in similar situations in the United States; and the same may be said of other numerous

manufacturing establishments. But he acknowledges that the American views have not resulted in a universal application of the belt principle, as ought to be the case.

Doctor Schlink also remarks that Prof. Radinger is greatly mistaken when he says that "in all Europe there is no toothed wheel moving with a greater velocity than 17 meters in the gearing teeth," as in the neighborhood of Mülheim, at the Ruhr, the gearing of the many wire works moves with a velocity of more than 20 meters (67 feet) per second.

Reckoning Dates in Remote Parts of the World.

Every one who has read that useful novel of Jules Verne, entitled "Around the World in Eighty Days," must have admired the ingenious advantage he takes of the fact that in travelling around the world in an easterly direction, thus against the apparent course of the sun, each day is a little shorter, so that after we have made the whole circuit we will have counted a day more; thus in doing it in 80 days, each day is on an average one-80th shorter, the result being that when we count 80 days on coming home, those who staid at home will only have counted 79 days. Verne introduces a traveller who thinks he is a day too late, as he has counted 81 days, while he gains the wager by coming to the club, with which he made the wager, exactly on the 80th day. He also brings with him a beautiful lady whom he has saved in India from being burned alive, and of course marries her, so as to give the story a touch of romance.

The book referred to is very instructive in regard to several points of modern geography not universally known, and as such we recommend it for perusal, as we do most of Verne's stories. If the traveller had gone westward, he would of course have lost a day instead of gaining one.

The accompanying map, taken from Schedler's "Manual for the Use of the Globes," shows where the division line is, which is called the "international date line." It is to be regretted that the line does not go straight north and south at the 174th meridian of longitude, through Behring's Strait and Chatham Islands; but by a deviation it has been agreed to include the Manila Islands in the reckoning of the American continent, notwithstanding the fact that New Zealand, lying some 400 miles farther east, reckons with Europe and Asia. East of the curved line on the map, it will be, for instance, the first day of the month, or say Sunday; as soon as the ship passes the line they find that the people count the second, or Monday, and if they return the same day it becomes Sunday again. Thus between the Manila Islands and Japan or Australia there is always a day's difference, and the people there can travel neither east, north, nor south for say 100 or 200 miles, without having to change their reckoning of dates one day ahead.

To understand this better, let us suppose that it is midnight between December 31 and January 1; midnight of the new year in Japan and Australia, and it will only be midnight between December 30 and 31 on the Manila Islands, while it will be about 6 o'clock in the morning on December 31 in America, noon in Europe, and evening of December 31 in Asia, at the same time in China it is late in the night of December 31. A few hours later, after midnight there, it becomes morning of January 1, then noon and evening, and when midnight between January 1 and 2 is reached in Japan and Australia, it will be only New Year's morning at the Manilas, while at the same time we in New York are making our New Year calls.

Smelting Ores without Fuel.

A recent number of the London *Times* gives an account of a new method of smelting copper without fuel, invented by Mr. John Hollway, of London. His method is based on the same principle as in the purification of iron by the Bessemer process, namely, after a mass is sufficiently heated the heat is kept up by a powerful blast of air, which burns out the combustible impurities, such as carbon, sulphur, silex, etc. It appears especially adapted for pyrites, which, being sulphids of copper and of iron, contain such a large proportion of the combustible sulphur that it is sufficient to keep up the heat, the result being sulphurous gas, while a large proportion of the sulphur evaporates, and can be recovered by condensation, as is customary in all sublimatory processes.

The only carbonaceous fuel required is a little wood and coke to start the fire; then the pyrites are put in, while afterward the fire is continuously fed by them, similar to the way in which an ordinary fire is first started with wood and afterward continuously fed with coal—the pyrites being here the regular fuel, while the powerful blast is sufficient to keep up their combustion.

The test of this method was made by using a few cupola furnaces belonging to Bessemer works. The first cupola was closed at the top and fitted with a Bessemer hearth, the blast being supplied through it to the cupola. The cupola has a forehearth or receptacle for the slag and regulus, which flow into it as they are formed. The slag runs continuously off at the top, while the regulus settles at the bottom, whence it is tapped off at intervals. The ore is fed to the cupola by means of the usual cup and cone arrangement placed near the top, and which prevents the escape of the gases. These are led off into the second cupola, which is closed at the top; here they encounter a jet of water, which cools the gases and condenses the crude sulphur and other sublimates. The uncondensed portion of the vapor passes on to the third and fourth cupolas successively, which are open at the top, and in each of which there is a shower bath of water, by means of which final condensation is effected. The condensing water is led away to a tank, where any sublimates that may be carried over with it are afterward collected.

In the first experiment the cupola (No. 1) was heated with a coke fire and the blast started. Cupreous pyrites (containing 1.7 of copper by wet assay) and a little charcoal were then charged into the cupola, and when a fluid bath of the molten sulphid had been obtained, pyrites and sandstone alone were fed in at the rate of five tons per hour. When twelve tons had thus been disposed of, the deposit of sulphur in cupola No. 2 had become so great that it choked the passage between it and No. 3. It was therefore satisfactorily proved that the heat developed from the pyrites was amply sufficient for melting the charge, while the successful condensation of the sulphur was but too evident. The copper and iron produced were, moreover, concentrated into a regulus of excellent quality. The object of further experiment was to show that a good regulus could be obtained without great loss of copper in the slag. As the collection of the sulphur had already been satisfactorily demonstrated, the smelting cupola was disconnected from the condensers and worked by itself. In the course of the experiment, however, defects developed themselves in the apparatus which had been extemporized out of that used for another process altogether, and had not been specially constructed. The value of pyrites, however, was established beyond question as a source of heat. On one occasion, when the heat of the furnace had accidentally lowered by underfeeding, it was speedily raised to a high intensity by simply feeding in more pyrites. It was indeed remarkable to see how the temperature was rapidly raised and then maintained by a fuel which can only be compared to stones. On analyzing the slag, it was found that it contained only one-25th of one per cent of copper, thus conclusively proving another point. Upon assay, the regulus was found to contain within a fraction of the whole of the metal known to exist in the ore used.

This invention is of great importance as regards localities where these heat-bearing minerals abound and where carbonaceous fuel is correspondingly scarce, and the process promises to exert a considerable influence upon the practice of copper smelting generally. The chief expense as regards fuel, is that incurred in raising steam for the blowing engines. Where, however, water power is available, it can be utilized for this purpose and steam boilers dispensed with.

Man's Occupations and Mortality.

The statistics of mortality in Massachusetts since 1843, teach some instructive lessons in regard to the influence of a man's occupation in his chances of longevity. We extract a few data showing the average duration of life for various occupations: Gentlemen of leisure, 68 years; farmers, 66; judges, 64; light-house keepers, 63; female nurses, 62; basket makers, 61; pilots, 60; sextons, ship carpenters, bankers, and clergymen, 59; professors of colleges, 57; lawyers, 56; physicians, 55; clock and watch makers, sheriffs, and policemen, 53; wharfingers and butchers, 51; editors of political papers, 47; peddlers, 46; artists, 44; dressmakers, 43; druggists and dentists, 42; musicians and music teachers, 41; saloon keepers, tobacconists, printers, railroad agents, and conductors, 40; milliners, factory girls, and domestics, 39; glass-blowers and powder mill employees, 38; clerks and book-keepers, 36; plumbers and carvers, 35; female school-teachers, 32; telegraph operators, 28; brakemen on railroads, 26.

Two Remarkable Boiler Explosions.

Two horizontal tubular boilers exploded at Cambridge, Mass., one filled with water, while the other contained no water at all. The first boiler (Fig. 1) was nine years old, 4 feet in diameter, and 17 feet long;

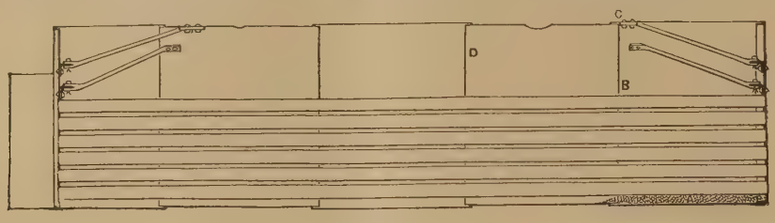


Fig. 1.

longitudinal seams double riveted, shell best quality of C No. 1 iron five-16ths of an inch thick, heads ⅞ inch thick, well braced, safety valve 3 inches in diameter, and had been examined by a U. S. government inspector and subjected by him to a hydraulic pressure of 150 pounds per square inch; considered safe at 100 pounds.

Fig. 1 is its longitudinal section as originally made, omitting the patches which had been put on since, but showing at A the location of the deposit which permitted the iron beneath it to become overheated. By the explosion three persons were killed, and a number of others wounded. An unusual interest was excited by this accident, and a number of experts were called to testify as to the cause of the disaster, and although there was no disagreement among trained boiler inspectors, still there was doubt expressed by one expert witness as to the original soundness of the iron, and the correctness of the construction and setting. The

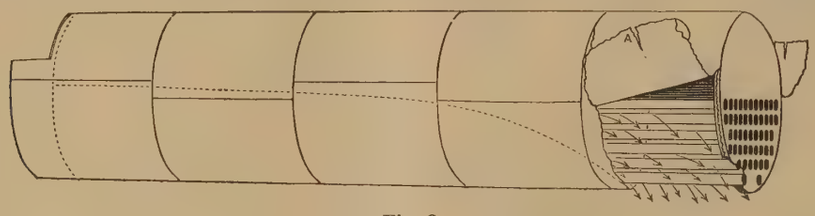


Fig. 3.

marks upon the plates of the back part of the boiler seemed, from the evidence, to plainly indicate a considerable deposit, and repeated repairs of the bottom of the shell had been made, all rendered necessary from overheating where sediment had prevented contact of the water with the iron. Whatever the character of the iron and the faults of construction may have been, there would seem to have been sufficient warning of approaching disaster to have prompted a greater degree of care in inspection and cleaning.

The boiler was worked at a pressure of about 75 pounds per square inch, and it was allowed to come to repair repeatedly without any inspection, till at last it exploded with destructive force, the larger portion, consisting of about four-fifths of the shell, and containing all the tubes, was projected through the side of the building a distance of 150 or 200 feet into an adjoining canal, where at low water it was photographed. The initial rupture was undoubtedly at A (Figs. 1 and 2), the iron having

Fig. 5.

been weakened by frequent overheating for a considerable distance along the bottom, and the usual working pressure was sufficient to rend it and allow of the instantaneous escape of the steam, which, owing to its activity, would pass through the mass of water, driving a portion before it, and enlarging the initial opening, as shown in Fig. 3, and an instant may now be conceived of in which the water is being disintegrated and expanded with such suddenness as to give the character of an explosion, and be made to fill the entire boiler, whence it would be projected like a charge from a cannon by the expansion of the nascent steam against the rear head of the boiler, there being little resistance in that direction now that the opening has been made continuously larger during the escape of the steam and the portion of the water that obstructed its flight at the instant of first rupture. The parallel surfaces of the shell and tubes direct the mass of foamy water which still retains a fair percentage of its original specific gravity, so that its inertia or momentum carries enough of it past the opening to tear the boiler apart, as shown in Fig. 4, and the principal part takes a rocket-like course, a distance which is determined by the quantity of expanding elements that it contains and the freedom with which it can escape. We have good grounds for the theory of the instant of time that occurs between the first gush of steam and the main explosion, (although the process is practically continuous), as in the testimony of eye-witnesses who often, at coroners' inquests, have said they heard a great rush of steam followed by a loud explosion.

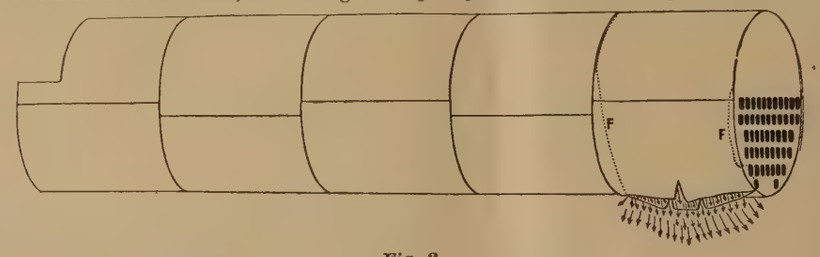


Fig. 2.

In this case a doubt was expressed by some of the witnesses as to the probable location of the initial rupture, but none of the practical boiler inspectors who were called expressed the least doubt as to the presence of a considerable deposit at A, Fig. 1. The weakest point, originally, may have been the seam C B, owing to faulty workmanship, but when the heating had so reduced the strength of the plate at A, which has to sustain just double the strain per unit of longitudinal measurement that is sustained by the same transverse measurement, there would seem to be little doubt in the minds of practical men where the fracture started, even though statistics did not, as they certainly do in most cases clearly point to that as the direction of initial fractures.

The bracing, which was charged by the same witnesses with contributing to the weakness, does not sustain the portion of the head above the tubes as completely as the tubes do the portion in which they are secured, but the transverse seam C B ought not to be the weaker because the bracing is attached between it and the head. For, suppose the head were so constructed as to be self-supporting, which is often the case, as with ribbed heavy cast-iron or hemispherical wrought-iron heads in plain cylindrical boilers, without tubes, then the seam C B would be called on to sustain the entire load on the area of the head, and even this is but half what is put upon the seams E E, etc., per lineal unit of seam measurement—*not* per square inch.

There is, therefore, no need of charging this sad accident to any mysterious agency, notwithstanding the attempt made by one of the witnesses, who has a reputation in some circles as an expert in boiler explosions, to surround the subject with an air of mystery by testifying as follows: "In the United States Commission experiments we have tried five times to burst a boiler, and failed. The first time it went up to 160 pounds, and the steam came out of thousands of little holes.

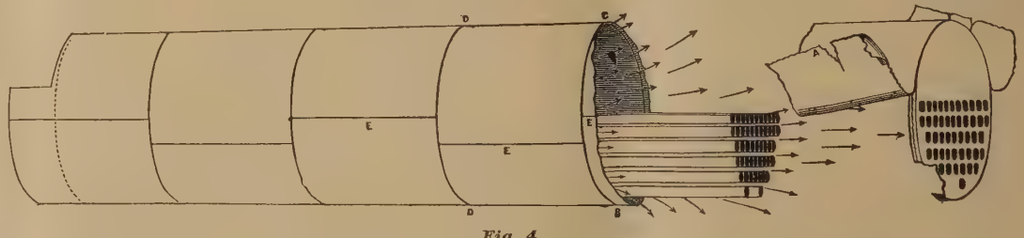


Fig. 4.

Another very curious thing is, that when the pressure had run up to 225 pounds, these little leaks were substantially tight. When you try to burst a boiler, it is a very hard thing to do," and more of this sort of talk.

Another explosion, which took place previously, tends to confirm the theory above offered. The boiler was of precisely similar construction, shown in Fig. 5, and at the time of the explosion contained no water at all. It will be seen that the rupture is similar to that supposed to be the initial rupture in this case, and had the boiler (Fig. 2) contained no water, the damage would have stopped here. The boiler (Fig. 5) did not leave its setting, but dropped on the bridge wall, the fire front, which supported the front end, having been thrown down by the first gush of steam.

We are indebted for the above illustrations to the Hartford Steam Boiler Inspection and Insurance Company.

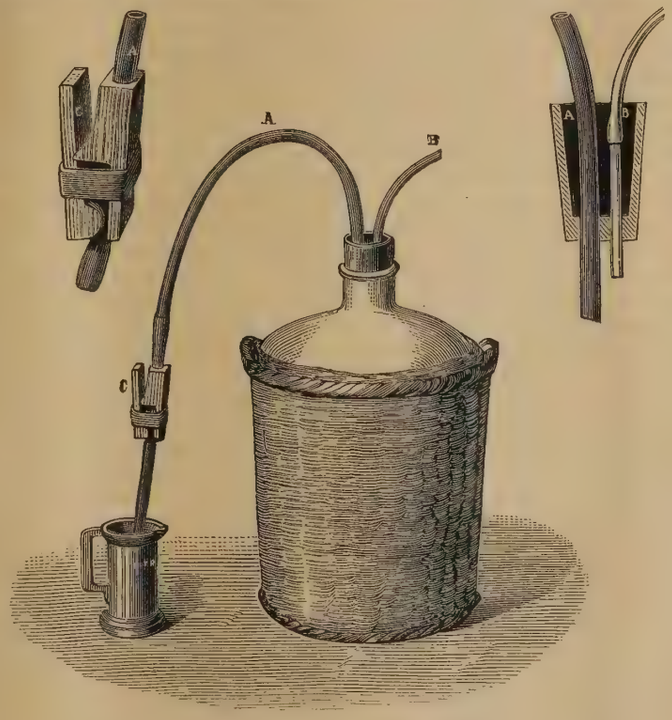
The following contains only a part of the business of this company for the two months ending May 31, 1879, reports from one of the largest departments not having

come in. The work of the other ten departments foots up as follows: Whole number of visits of inspection, 2,096; boilers examined, 4,322, of which 1,821 were thorough annual inspections. The hydraulic test was used in 380 cases. The whole number of defects reported was 1,882, of which 269 were dangerous. Furnaces out of shape, 84—6 dangerously so. Fractured plates, 164—68 dangerous. Burned plates, 117—13 dangerous. Blistered plates, 236—20 dangerous. Cases of sediment and deposit, 274—28 dangerous. The cases of incrustation and scale were 334—16 dangerous. External corrosion, 124—23 dangerous. Internal corrosion, 108—13 dangerous. Internal grooving, 8—3 dangerous. Water gauges defective, 42—4 dangerous. Blow-out apparatus defective, 26—7 dangerous. Safety valves overloaded, 23—5 dangerous. Pressure gauges defective, 187—29 dangerous. Boilers without gauges, 105. Deficiency of water, 2—2 dangerous. Braces and stays broken, 48—32 dangerous. Boilers condemned, 22.

Siphon Arrangement for Drawing Liquids.

All persons, whether they are chemists or not, who have ever drawn liquids from carboys or other very large glass bottles, know from experience the inconvenience of the operation, not to speak of the serious danger of breaking those that contain corrosive acids. In order to avoid the difficulties and dangers of tipping up the vessel, M. Lufberg proposes, in the French journal *La Nature*, the following device, which, so far as we know, is not patented.

The simple contrivance with which this is accomplished is represented in the adjoined engraving at the right-hand side. It consists of a rubber cork, or, in case of necessity, an ordinary cork covered with wax or paraffin; it is perforated with two holes, through which two tubes A and B pass air-tight. The first A is the short end of a thick rubber siphon, seen in the large figure; the second shorter one B, may be of glass, and is intended to blow into so as to exert a pressure on the surface of the liquid, when the stopper is inserted air-tight in the neck of the bottle. The siphon A has a spring squeezer C, which closes it by the pressure of a rubber strap, as seen at the upper left-hand corner. When the apparatus is to be used, all that is necessary is to press the upper part C of this squeezer to allow the rubber tube to expand, and then to blow into the tube B, which just perforates the stopper without reaching the liquid; the tube A being immersed to the bottom of the same, the air pressure introduced through B will cause the liquid to rise, and when it has been forced over the bend, it will continue to run as long as the exit at C is kept open. When the vessel into which the liquid is intended to be drawn is sufficiently filled, the squeezer C is allowed to close the rubber tube by simply withholding the pressure by the fingers on it. As long as the siphon A remains filled the liquid will always be ready to run on opening the exit C by pressure of the fingers. When it is not to be used for some time the siphon A can be emptied by lifting the opening below C higher than the bend A, and opening the squeezer C, when the contents of the tube will run back into the jar and air be admitted into the tube.



SIPHON ARRANGEMENT FOR DRAWING LIQUIDS.

Useful Application of a Scientific Observation.

We call the attention of our readers to the useful application made in France by M. Coquillion of the fact previously discovered that red hot palladium will absorb hydrogen gas, and also cause the combustion of various kinds of hydrocarbon gases, when mixed with air in any proportion. He applies it to an instrument intended to measure the amount of fire-damp in a mine, by passing a measured amount of air in the mine over a palladium wire, kept in an incandescent condition by an electric current, and measuring its change of volume. The instruments he constructed for this purpose are described in an article entitled "Determination of Fire-Damp in Mines," which appeared on page 158 of our July number.

Precautions Against Spontaneous Combustion.

It is a well proved, and therefore an undeniable fact, that machine-shops, mills, etc., have been destroyed by the spontaneous ignition of certain elements, the origin and nature of which are as perfectly known to science as they can be. In the case of oiled rags, almost everybody knows that heat is gradually developed by the absorption of the oxygen of the atmosphere, until the hydro-carbon of the oil ignites spontaneously. It is the nature of these elements to do so, and we need not be more astonished that such ignition should occur than if we were to apply a lighted match to gunpowder, and an explosion followed.

The covering or packing of a steam boiler is subject to the same result, namely, the heat of the boiler gradually carbonizes the covering or packing, and the hydrogen of the atmosphere uniting with it, is operated upon finally by the oxygen until ignition takes place. It is the same with wood-work exposed to continual or repeated heat, as the flooring under or surrounding a furnace or stove, or near a stove-pipe. Here, although the metal is not in contact with the wood, yet the heat of the metal carbonizes the atoms floating near it in the atmosphere, which, falling or settling upon the wood-work, accumulate to such a degree, and permeate the pores of the wood so completely, that the atmosphere operating upon it finally causes ignition, which consumes the wood.

At the Crescent Steel Works in Pittsburgh, Pa., a steam pipe 2½ inches in diameter, carrying from 90 to 100 pounds pressure, was laid underground about three years ago, encased in common pine boards about an inch thick. A few days since it was found necessary to dig up the pipe, and the whole length of the wooden drain was found to be charred and burnt about three-fourths of the thickness of the wood, the other fourth being partially rotted. The whole inside of the drain was turned to charcoal, with here and there spots of white ashes, showing that ignition had actually taken place. It seems probable that if the casing had not been excluded from the air by the earth-covering, it would have blazed and been entirely consumed. It is generally believed that a steam pipe cannot set fire to wood, but this case seems to prove the contrary, and it may explain the origin of many mysterious fires—it indicates at least that care should be taken to prevent the close proximity of easily combustible material to pipes carrying a high pressure of steam, and therefore hotter than pipes carrying ordinary low pressure steam, with which there is no danger of charring wood, much less of setting it on fire.

In machine-shops, particularly in mills where the machinery is run at a high rate of speed, the friction generated by the motion carbonizes the atoms which are always floating in the atmosphere, and which, penetrating everywhere, even into the pores of dry exposed wood, or other porous combustible material, bring about ignition silently but as surely as a direct application of fire. An explosion is often the consequence, but this is simply the rapid ignition peculiar to all hydro-carbons. It is useless to deny that cases of spontaneous combustion are increasing in frequency, principally in old establishments where the carbonizing process has been going on for years, or in those more recent ones in which nature is aided by the carelessness of man, and her otherwise slow but sure processes accelerated.

Perhaps a remedy would be a thorough renovation, and the use of plenty of incombustible paint on all surfaces exposed to igniting influences. Of course old and dry wood, saturated with carbon, could be prevented from any further chemical action, while new wood would have its pores filled up by the use of such paint to the exclusion of deleterious atoms.

Many of our hydro-carbons will not stand a fire test of 60°, and even those in common use do not rise above 110°; so that the heated atmosphere of our shops and mills, often much greater than this, will operate as too high a fire test.

A contemporary, in regard to these facts, makes the following sensible remark: "Precaution is much less expensive than the expenses of litigation to recover insurance, more especially since courts, led astray by professional experts, hold that the damage is caused by the explosion and not by fire—placing effect again before cause—shooting off the gun without igniting the powder."

Success of Henry Bessemer.

It is difficult to estimate the immense monetary value to human society of the sewing machine and the electric telegraph, and consequently to determine whether the inventors and improvers have been proportionately rewarded, which certainly they have not, largely as some of them may have profited by their labors. It is, however, different with the Bessemer process, for the saving can be figured down to a nicety on every ton made, and the annual product of the various civilized countries is pretty accurately known. From data thus collected it is estimated that in labor and material the world is a gainer to the amount of $100,000,000 a year by using the Bessemer process in converting ore into steel. Or, considered in another way, the advantage of a low-priced, enduring metal, such as Bessemer steel, when compared with iron, has been made a matter of calculation, as far as railroad tracks are concerned, with the following astonishing results: Mr. Price Williams, who is an expert in matters of this kind, has stated that by substituting steel for iron a saving in expenditure will be made during the life of one set of steel rails on all the existing lines in Great Britain, of not less than $850,000,000.

In view of these facts, says the New York *Sun*, if Henry Bessemer has obtained in royalties the sum of $5,250,000, most persons will concede he has got no more than he deserves, and he has had an experience

that few inventors are allowed to have, in living to see the world-wide results of his invention, and realize the economy in resources which has been made possible by its use.

Scientific.

Science in the Public Schools.—An experienced teacher in one of the New York city public schools is reported lately to have expressed himself as follows: "Our schools are burdened with too many studies, ologies, isms, and crotchets of eccentric examiners, who exact of others what they never could do themselves."

There is, no doubt, a great deal of truth in this, but unfortunately some of the daily papers make this expression the theme of long lamentations that instruction is degenerating; that all sorts of fantastic theories and notions have crept into the profession of teaching; that a lot of pedagogues have been bred, who are not satisfied with confining themselves to teaching growing mankind the essential parts of a practical education—reading, writing and arithmetic, but who stuff them with a variety and quantity of information which it is impossible for them to digest. Then the supposed unnecessary branches are enumerated. They are stated to be: "The meaning and use of at least twenty Latin roots; drawing, of which it is complained that it consumes considerable time; also astronomy, the structure of the human body, natural philosophy, music, and the analysis of sentences."

The mixed up enumeration of these branches, and their condemnation as equally useless for an ordinary citizen who does not intend to study for any of the learned professions, is simply a proof that the writers of such articles are utterly ignorant of any science, and consequently of the great value of most of them for every human being.

In half-civilized countries the common people do not learn to read and write at all; among more civilized people it is supposed to be necessary that every child should learn these essentials of civilization; but in an enlightened republic like the United States, where every citizen is a sovereign, and called upon to take part in the affairs of state, and which aspires to be at the head of the world's industrial progress, something more is required than mere reading, writing and arithmetic, which, to be sure, are the keys to further knowledge; but if by early application to some useful branches of knowledge the mind of the young is not directed into the right channels, and a taste developed for the acquirement of solid information, all the use they will afterward make of their knowledge of reading will be the perusal of silly stories and trashy novels. The ready sale of a certain class of books is a convincing proof of the truth of our assertion.

If then it is necessary to introduce instruction in some branches of knowledge in our public schools, the question is one of choice of the subjects to be taught, as it would be unwise to introduce indiscriminately everything that happens to fall under the attention of those who are called to regulate these matters.

The subject has to be considered from two aspects: 1st. What branches are absolutely necessary, what others are merely desirable, and which can, without harm, be entirely disregarded in the present state of society. 2d. What subjects of study have the best influence in developing the practical judgment, and in general the minds of the pupils. This is a very important point, as most branches as thus far taught merely consist in an exercise of the memory, and, what is the worst feature of it, a mere mechanical memory for words and names, and not for facts.

If, without any prejudice, we consider the study of languages, we are forced to the conclusion that the Latin language, and even the study of any roots, is better entirely dispensed with; people who know nothing else than perhaps some Latin, may not agree to this, but they are not competent judges. To give a fair judgment on such a matter requires a knowledge of most, if not all the branches of modern knowledge; and any one who has the good fortune to have obtained such knowledge, will agree with us that there are so many infinitely more important and useful things to be studied at the present day that we cannot afford to neglect absolutely necessary things for others merely ornamental. The fact is, that the study of Latin and Greek became prevalent in olden times for the simple reason that there was so little known that it was impossible to keep students busy, and as they had to learn something, the best choice possibly was these classical languages. But times have changed; in practical knowledge the ancients were like children, or savages, compared to the present generation, and we can scarcely learn anything practically useful from old writers.

Geography and history have for some time been considered necessary branches to be taught in public schools; and so they are. A general knowledge of the earth on which we live, of the various nationalities which partake with us of the advantages it offers to mankind, and some knowledge of the struggles of man to attain his present improved condition, may be considered necessary for every educated man and woman, but we ought to object to the manner in which these branches are taught in most schools, which make these studies distasteful by confining the students to recitations from text-books. This is a great mistake, and simply proceeds from ignorance among teachers, who in that way try to teach their classes things which they themselves neither know nor can remember.

Some knowledge of modern astronomy should be communicated by the teacher, and this not by learning lessons, but by lectures and explanations, aided by proper diagrams; it gives the pupils a conception of the grandeur of the universe, especially when, as a contrast, the minute structure of the human body is explained. These two branches, in combination with natural philosophy, which explains those phenomena of nature immediately surrounding us, are the best basis for religious culture, as they teach all to respect and admire the wonderful powers which pervade the universe. The direct practical usefulness of the study of the human body is manifold; should not man know his own body, and learn how to take care of it? Many ailments and premature deaths may be traced to ignorance in this respect. Do not many men ruin their bodies with strong drink, and other indulgences, as though they could obtain another when their present body is worn out? Its study can only be productive of good; and it is the same with the study of the nature in which and by which we live and have our being, and without which our body cannot exist, as it is not only dependent upon, but a part of it.

In regard to drawing, besides its usefulness to most trades, it has a very beneficial influence in the development of the mental faculties, especially drawing after nature, as it teaches the pupil to *see*, to see carefully and correctly, to see details, to see things as they really appear to the eye, and to become cautious in judgment about objects seen. A pupil who has learned to draw well has always a better developed mind than those ignorant of drawing. It is the same with music, which, besides being a very desirable accomplishment, does for the ear what drawing does for the eye, and also develops the natural capacity for rhythmical motions to the utmost, in the same way that drawing develops the taste for correct proportions, because what time is for music, shape is for drawing.

The above are only some suggestions, the further development of which we leave to the reflecting reader. Having been suggested by the present discussions in regard to the branches to be taught in the public schools, we ought to add that we by no means would insist upon following the same course for all pupils; let only those who love music and have a natural disposition for it, obtain some preliminary knowledge which will aid them when afterward they devote more time to it, as music is a study which, in order to acquire even the smallest degree of proficiency, requires more time than can be given to it in any public school.

Drawing we should recommend to all, and pupils may be put to it quite young, especially when they possess some natural talent, and like it, which most all children do. It requires, however, an able instructor to make the pupils reap all the benefits.

But this is the case with all branches of study, especially those that are more influential in developing other faculties of the mind than a parrot-like memory, against which we always most earnestly protest, but which unfortunately is the most cultivated, as by it the pupils make the most striking display at public examinations, at the expense, however, of other and much more important mental faculties, which become crushed by the over-straining of the faculty of memory for words and sounds.

Chemical Tests.—At the request of several readers we will here give a list of the substances used for chemical tests, called "reagents," most commonly used for ordinary purposes, and add to each a few lines in regard to their use.

1. *Distilled Water*, (formula, H O).—In most cases pure rain water may be substituted. It is chiefly used for dissolving such solids as are soluble in water, in order to prepare them for the test.

2. *Ether*, (formula, C_4H_5O).—Chiefly used for extracting fatty ingredients from a given compound. It is also used to detect and isolate bromin.

3. *Alcohol*, (formula, $C_4H_6O_2$).—Used as a solvent for extracting certain substances not soluble in water. It will also precipitate substances which have been dissolved in water and are not soluble in alcohol.

4. *Sulphuric Acid*, (formula, SO_3HO).—Used as a solvent for many metallic substances, forming with them sulphates. Also a special test for barium, strontium and lead compounds, producing in these solutions a white precipitate.

5. *Nitric Acid*, (formula, NO_5HO).—A more general solvent for metals, except the noble ones, among which it only dissolves silver. It is also a powerful oxidizing agent.

6. *Hydrochloric Acid*, (formula, HCl).—Also a solvent for many metals, and a special test for solutions of silver, mercury, and lead, with which is produces a white precipitate. Its vapor forms a white chlorid with ammoniacal gas.

7. *Nitro-Hydrochloric Acid*, (*Aqua Regia*).—The only acid that will dissolve gold and platinum, and decompose certain metallic sulphids.

8. *Oxalic Acid*, (formula, C_2O_3HO).—Its solution a special test for lime. It produces a white precipitate, or at least milkiness in solutions of lime compounds.

9. *Tartaric Acid*, (formula, $C_8H_4O_{10}$).—A special test for potash. It produces in potash solutions a crystalline formation of cream of tartar, and is used to prevent the precipitation of certain metallic oxids by alkalies.

10. *Baryta, Caustic, Nitrate, Acetic, and Chlorid.*—Special tests for sulphuric acid or sulphates, producing a white precipitate in their solutions. The caustic baryta produces a white precipitate in magnesia solutions.

11. *Potassa, Caustic*, (K O), is used as a solvent of some and as a precipitant of other solutions, separates some oxids from others, and drives free ammonia out of all its salts, so that it can be detected by the smell.

12. *Carbonate of Potash* (KO, CO_2) is used as a precipitant, and for the decomposition of many insoluble salts, especially organic with metallic bases.

13. *Sulphate of Potash* (KO,SO_3) is used to precipitate baryta and strontia, if the use of free sulphuric acid is objectionable.

14. *Cyanid of Potassium* (KCy) is used to separate cobalt from nickel, and to reduce arsenic by heat, but mostly used as a flux for the blow-pipe.

15. *Ferrocyanid of Potassium* (K_2Cfy) is used for detecting sesquioxid of iron and oxid of copper.

16. *Ferrid Cyanid of Potassium* (K_3Cfy_2) is used to detect protoxid of iron, with which it forms Prussian blue.

17. *Nitrate of Potash* ($KO\ NO_5$) is used as an oxidizing agent.

18. *Biborate of Soda* ($NaO,2BO_3$) is used as a flux for the blow pipe.

19. *Phosphate of Soda* ($2NaO, PO_5$) is a test for alkaline earths in general, especially magnesia.

20. *Phosphate of Soda and Ammonia*, (NaO, NH_4O, PO_5, HO).—It is the most important blow-pipe reagent, as it fuses almost every chemical compound, hence its name of "microcosmic salt."

NEW USES FOR NICKEL AND COBALT.—It has been discovered by Theo. Fleishmann that the cause of the hardness of many specimens of nickel and cobalt is due to carbon, or carbonic oxid, which even as in iron destroys its malleability. Taking advantage of the scientific discovery that metallic magnesium possesses the preperty of decomposing the oxids of carbon, Mr. Fleishmann introduced a small quantity of this metal, and found that as little as $\frac{1}{8}$ of one per cent is sufficient. The change was great; the metals not only became malleable, but could be welded at a white heat like iron and platinum, which, especially in the case of cobalt, is very striking. This malleable nickel and cobalt have been welded together with plates of steel and iron, and rolled out or beaten out, while the coating remained as entire and as equally covered the metal under it as does gold or silver when plated on copper or brass. No doubt from this discovery advantageous applications may be expected.

It appears that nickel is even perfectly malleable when cold, but this is not the case with cobalt; this metal is only malleable when hot, but when cold is as hard as steel, so that it is proposed to use it for fine cutting instruments, which may be very valuable for surgery, as such instruments will not rust, cobalt being almost a noble metal, taking, as well as nickel, a very high polish.

We ought to add here that these metals, when deposited in the pure state by the dynamo-electric machine, are also malleable. Mr. E. Weston, of Newark, N. J., has shown us specimens of nickel in plates deposited by his machines, which were as flexible as copper, and which will deposit 4 tons of metallic copper per day from a solution; so that we now possess two methods of obtaining these metals pure—first, the method of Mr. Fleishmann, described above, by making an alloy of commercial nickel with magnesium metal; and the second and better method of obtaining the nickel metal from a proper electroplating solution by means of a current of such intensity as required for the purpose.

THE PERFECTION OF NATURE'S WORKS.—Upon examining the edge of the sharpest razor with the microscope, it will appear fully as broad as the back of a knife—rough, uneven, and full of notches and furrows. An exceedingly small needle resembles an iron bar. But the sting of a bee seen through the same instrument exhibits everywhere the most beautiful polish, without a flaw, blemish, or inequality, and ends in a point too fine to be discerned. The threads of a fine lawn are coarser than the yarns with which ropes are made for anchors; but a silkworm's web appears smooth and shining, and everywhere equal. The smallest dot that is made with a pen appears irregular and uneven; but the little specks on the wings of insects are not only found to be perfect and regular, but to often show elaborate designs of a detail which is the admiration of the microscopist.

ANOTHER NEW ELEMENT.—Prof. Kœnig, of the University of Pennsylvania, announces that he suspects the existence of a new metallic element in a mineral resembling schorlamite, occurring at Magnet Cove, Arkansas. In an examination of this mineral, he obtained, instead of titanic acid, a white oxid which differed very decidedly from the former. He is disposed to regard this circumstance as pointing most probably to the existence of a new metal in the mineral in question.

Thus the number of elementary bodies is still increasing, notwithstanding the so much heralded discoveries of the unification of several supposed elements.

A NEW PRESERVATIVE COMPOUND.—It has been found that the double borate of potash and soda has antiseptic properties. The compound is made by dissolving equal quantities of chlorid of potassium, nitrate of soda and boracic acid; filter the solution, evaporate to dryness, and keep in a tight bottle, as the salt becomes wet in the air. It is claimed that this salt has no effect on the smell, taste, or healthfulness of the substances to which it is added. It has been tried for preserving meats, making sausages, butter, and for tanning skins. Added to milk it will keep for a week; also added to beer or wine it retards the deterioration to which the inferior kinds of these drinks are subject.

How to Find the Bearing Strength of Timber.

Prof. Carpenter, of the Michigan Agricultural College, furnishes some illustrations of the well-known rules for finding the weights that timber of a given size, supported at both ends, will sustain, and which, by reason of their practical usefulness, we republish:

1st. If a weight be uniformly distributed from end to end on a horizontal beam, it produces the same effect on a beam as though one-half of the weight were gathered at the center of the beam.

Example.—A horizontal beam, 16 feet in length, sustains a floor 2 feet each side of it. If the weight of the floor, and the load that may be expected to be put upon it, be taken as 75 pounds per square foot, we should find the total load sustained by the beam to be its length multiplied by the number of square feet sustained, multiplied by the load on each square foot, or $16 \times 4 \times 75 = 4{,}800$ pounds. This would be equivalent to a center load of 2,400 pounds.

2d. (Converse of 1st.) If a beam sustain a certain load at the center, it will sustain twice as much load provided it be uniformly distributed.

3d. The safe load should not exceed one-fourth or one-fifth the breaking load in bridges, or in floor subject to much vibration from moving bodies. In roofs the safe load should not exceed one-fourth or one-third the breaking load. These precautions are necessary for two reasons; timber is injured by a load much below the breaking load, and imperfections in workmanship and material are constantly occurring).

4th. The safe load is assumed to be one-fifth the breaking.

To find the safe load that a horizontal pine beam, supported at both ends, will sustain:

Rule.—Multiply the breadth of a beam by the square of its depth, and that product by the number 90; divide this result by the length of the beam between the supports, and the quotient will be the number of pounds in the load that the beam will safely carry at the center. If the load is uniformly distributed it will be twice the safe center load, and the foregoing result may be doubled to obtain the total distributed load. (see rules 1st and 2d). If any material besides pine is used, instead of the number 90, the numbers in the following table must be used:

White oak	120
Red or black oak	110
White ash	130
Swamp ash	80
Black ash	60
White beech	90
White cedar or arbor vitæ	50
Walnut	90
Tamarack	80
Spruce	90
Maple	110
Hickory	140
Rock elm	70
Locust	120
White pine	90

Example.—What will be the center safe load of a pine beam, 4×6 inches, supported at two places, and 12 feet long between the supports?

1. If the depth be 6 inches and the breadth 4 inches, the center load $= 4 \times 36 \times 90$ divided by $12 = 1{,}080$ pounds.

2. If the depth be 4 inches and the breadth 6 inches, the center load is $6 \times 16 \times 90$ divided by $12 = 720$ pounds. From these examples it will be seen to be always most economical to set a horizontal beam on its edge, or place it so that the greatest dimension shall correspond to its depth.

5th. To find the weight that an inclined beam (a rafter for instance) will safely bear at the center distance between supports:

Rule.—Find the center weight that a beam of length equal to the horizontal span or spread of the inclined beam will safely sustain, by the 4th rule; divide this result by the horizontal span of the inclined beam, and multiply it by the length of the inclined beam.

Example.—What will a pine rafter 20 feet long, with 12 feet rise and horizontal span of 16 feet, if 2×4 inches, sustain safely at center when there is supposed to be no support at its center? If horizontal and 16 feet long, the safe center weight $= 2 \times 16 \times 90$ divided by 16, or 180 pounds, dividing this result by 16 and multiplying by 20, the safe center weight is 220 pounds. This would correspond to a uniformly distributed load of 440 pounds. If this rafter be supposed to carry 2 square feet for each foot in length, the load would be 104 pounds to each square foot.

Note.—A rafter of these dimensions would need a support at the center; in that case its horizontal span would be 8 feet instead of 16. The result would be a safe center load of 440 pounds, or a safe distributed load of 880 pounds—but this is distributed over a rafter 10 feet long instead of 20, so that on the same supposition as before the safe load becomes 41.6 pounds per square foot—a safe load for any roof.

Remarks.—This rule, although sufficiently exact for ordinary purposes, and safe for ordinary roofs when the factor of safety (5) is used, must be replaced by more exact and complicated rules when very exact results are required. This is safe for all farm buildings.

6th. When the dimensions of a horizontal beam that will safely carry a given load are wanted, the following rule must be used: The product of the breadth into the square of the depth equals the load at the center divided by 90 for pine, or by the numbers given under the 4th rule for any other material. By assuming the depth the breadth can be found.

Example.—What sized pine beam, 16 feet long, will safely support 1,000 pounds at its center? 1,000 divided by 90 equals 11.1—equals the breadth multiplied by the square of the depth. If we assume the depth to be 3 inches, its square is 9 and the breadth 11.1, divided by $9 = 1.3$. Hence the answer is a piece 1.3×3. When the load is distributed over a number of square feet, the center load must first be found by multiplying by the number of feet and dividing by 2.

7th. If the beam is inclined, divide the center load by the length of the beam. Multiply this quotient by the horizontal space, and proceed as in the 6th.

8th. The amount an upright beam will safely carry when subjected to a pulling strain, can be found by multiplying the number of square inches of its cross section by the strength of 1 square inch.

The following table gives the safe strength of different woods in pounds per square inch:

Ash	3,200
Elm	1,200
Hickory	2,200
Maple	2,000
White oak	2,000
Pine	2,000
Walnut	1,000
Poplar	1,400

9th. The amount an upright post, loaded at the upper end, will sustain, can be found approximately in the same way as the tensile load; the amount per square inch should be taken about four-fifths that given in rule 8th. This is an approximate rule that cannot be relied on in cases where very accurate results are required.

These rules give accurate results, with the exception of rules 5th and 9th. The results given by rule 5th are safe, and do not differ much from the true results. Those given by rule 9th, for the size of posts, are very nearly correct when the posts are of moderate length.

The Clement Band Saw Machine.

The advantages of band saws over to-and-fro saws, evident from the nature of the difference in the motion, are only fully realized when a workman who understands the management of a to-and-fro moving scroll saw is given the use of a band saw. He finds that it turns out three times the amount of work in the same time, while the greater convenience of handling it is still more considerable, especially on account of the regularity of the motion of the saw being always in one direction, and therefore far more quiet and less fatiguing to the operator than when he is confined the whole day to the use of a to-and-fro saw.

Saws of this kind, however, belong to the more expensive class of machinery; it is, therefore, natural that a demand should have sprung up for such as could be had at a diminished price. There are two ways to cheapen the cost of a machine; one is to spend less labor upon the working parts, regardless of their correct adjustment; the other is to omit all useless or non-essential things—showy polish and ornamental paint, while spending all the necessary labor upon the working and essential parts. The latter course has been adopted by Mr. Frank H. Clement, of 122 Mill street, Rochester, N. Y., who is making the manufacture of band saw machines a specialty, having carefully studied various designs and improvements with the object of finally producing a good, substantial, and practical machine, which he claims to have accomplished, with a large reduction in the cost of manufacture.

Two of these machines are shown in the adjoined engravings. Fig. 1 represents a kind for which there is great demand, being especially adapted for all kinds of light scroll sawing. However, he also makes larger machines of different patterns for heavy work. The heavier and larger kinds of these machines are represented in Fig. 2; but in order to make the iron frames of these machines strong with the least possible weight, they are cast hollow. Two sizes of these machines are made in the style shown in Fig. 2, of 32 and 37 inches respectively, their weights being 800 and 1,100 pounds. They possess all the necessary adjustments, tilting tables, etc. The manufacturer, in fact, makes all kinds of band and jig sawing machines, turning machines, and cabinet makers' machinery in general.

The machines here represented are unlike anything now in the market; the material is distributed according to the best principles of construction, and they are designed with special regard to strength, durability, simplicity, and accurate workmanship. Every part necessary to do band sawing successfully is present, and all necessary adjustments are provided. The tables are of hard wood, (unless otherwise ordered), and glued up in strips. The main saw guides are of wood and steel, adjustable in every direction. The upper wheels rest on an expansion cushion, and are adjustable vertically and across their axis. The shafts are of steel, and have extra long bearings. The loose pulleys are self-oiling, and have very long hubs. The wheels are covered with rubber, and are very carefully turned and balanced; they are provided with an improved concave arm, rendering them very light and strong. The workmanship throughout is good, and every part that demands it is closely and carefully fitted.

These machines are delivered packed up, with wrench, scarfing frame and tongs, and one saw blade joined, at any point in Rochester without extra charge.

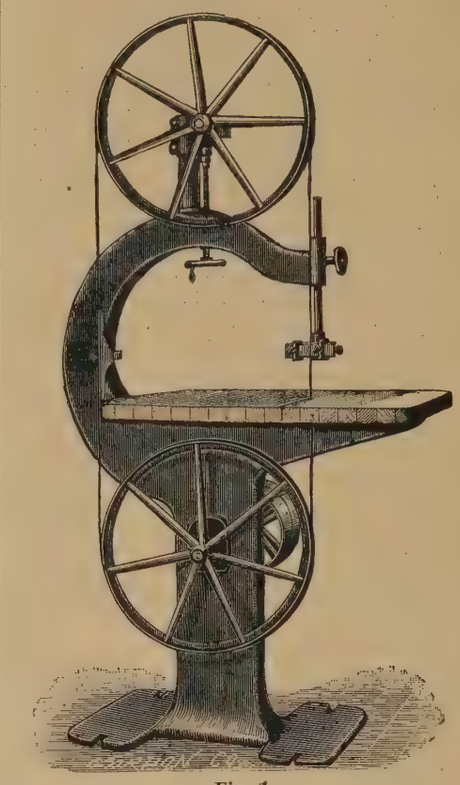


Fig. 1.

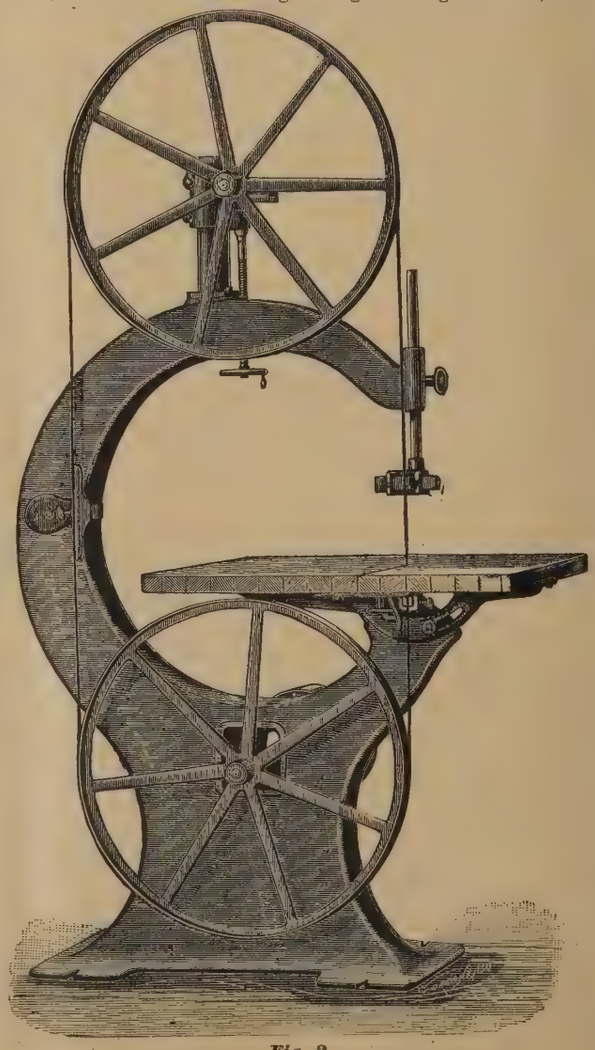


Fig. 2.

Cord-Making Machine.—Mr. Binns, a manufacturer in England, has invented machinery for making silk and woolen cords, which can be set in operation at the beginning of the week and will proceed to the end without being touched, so long as the steam engine continues to furnish power. These machines are run at the rate of 17,000 revolutions a minute, require no heald, reed, or harness to the warping threads. If a thread gets broken the machine mends the breakage and goes on again. The cords are developed and used up in new silk trimming goods, which are woven in combination with the cord, and at this work one girl, at $4 a week, can in that time produce this class of goods to the value of $500; in the endless window cord, $540; chain or sash line, $1,300; and this same girl, at $4 a week, in the silk, cotton, and woolen goods, can earn $5,000, for with this machine she is simply a cleaner and collector.

The principle underlying this invention, and which is probably secured by patent, is that of the endless spindle band, which is made on what may be described as a horizontal machine. The imperceptible joining is contrived by means of a small steel hook. The bands are all produced at one exact length, and there is no joint or knot to interfere with the turning of the spindles.

Wire Rope Transportation at the Reading Iron Works.

The *Iron Age* describes a system of wire rope transportation at the Reading Iron Works, which is expected to do away with much expensive handling and carting, and will offer a good example of a system which is rapidly gaining ground in Europe, and has been repeatedly used with success both in Eastern and Western States, although not to that large extent which its advantages warrant. At the Reading Works there will be three lines of transportation, the first of which will be 1,000 feet in length. It will be used exclusively for conveying pipes manufactured in the establishment to a siding along the Reading Railroad, 90 feet in length, where the pipes will be loaded upon cars. The second line will be 800 feet in length, and will be used for the transportation of anthracite coal, while the third line will be 300 feet in length, and will carry soft coal and pea coal to the rolling mill. The trestles vary from 20 to 45 feet in hight. The first line is supplied with two terminal and eight intermediate trestles, the second line with two terminal and four intermediate trestles, and the third line with two terminal and one intermediate trestle.

The main line will be equipped with an endless steel rope, 1¼ inches in diameter, which will run over sheaves or large wheels located upon the trestles, the rope fitting firmly into grooves in the circumference of each wheel. Grooved trucks will be fastened upon the chain, from which will be suspended hangers to support whatever articles may be transported. As this line will be used for carrying pipes almost exclusively, two trucks will be arranged in such a manner as to carry the pipes suspended upon the hangers. When the trucks reach the railroad siding they will be run from the endless rope upon the siding by an ingenious contrivance. From the center of the track to the center of the wheel the gauge is the same as from the center of the rope to the center of the wheel. Upon the truck reaching the siding, the rope shoots at an angle, and the truck is run upon the railroad track with its freight. The moment the wheel strikes the rail, the rope slips down and leaves the truck standing upon the rail. The truck is then disengaged from the rope and unloaded. While one line of loaded trucks is being conveyed from the pipe mill to the siding, a line of empty ones is at the same time being returned.

The operations of the other lines for carrying coal from the railroad sidings and dumping places to the pipe and rolling mills are of a similar character. The large sheaves, or wheels, are 8 feet in diameter, and the small sheaves are 2 and 3 feet in diameter. The coal will be carried in buckets suspended from trucks fastened to chains.

The power used in operating the endless ropes will be transmitted from a stationary engine by the line of shafting in the flue-cutting department of the pipe mill.

Latest Market Report of Building Materials.

NEW YORK PRICES.

ARTICLES MARKED WITH A STAR (*) ARE QUOTED IN GOLD.

—o—

LUMBER.

Pine, very choice and extra dry, per M	$55 00 @ 60 00
Pine, good	45 00 @ 50 00
Pine, shipping box	18 00 @ 22 00
Pine, common box	16 00 @ 17 00
Pine, common box, ⅝	13 00 @ 15 00
Pine, tally plank, 1¼, 10 inch, dressed, each	40 @ 43
Pine, tally plank, 1¼, 2d quality	35 @ 38
Pine, tally plank, 1¼, culls	25 @ 28
Pine, tally boards, dressed, good	28 @ 30
Pine, tally boards, dressed, common	22 @ 25
Pine, tally boards, culls, dressed	21 @ 23
Pine, strip boards, merchantable	16 @ 18
Pine, strip boards, clear	22 @ 25
Pine, strip plank, dressed, clear	33 @ 35
Spruce boards, dressed	18 @ 20
Spruce plank, 1¼-inch, dressed	22 @ 25
Spruce plank, 2-inch,	28 @ 34
Spruce wall strips	13 @ — 15
Spruce timber, per M	16 00 @ 19 00
Hemlock boards, each	14 @ — 16
Hemlock joist, 2½x4	15 @ — 16
Hemlock joist, 3x4	16 @ — 18
Hemlock joist, 4x6	40 @ — 44
Ash, good, per M	30 00 @ 50 00
Oak	32 50 @ 65 00
Maple culls	20 00 @ 25 00
Maple good	45 00 @ 85 50
Chestnut	42 00 @ 48 00
Cypress, 1, 1½, 2, and 2½-inch	35 00 @ 40 00
Black walnut, good to choice	85 00 @100 00
Black walnut, ⅝-inch	75 00 @ 85 00
Black walnut, selected and seasoned	110 00 @150 00
Black walnut counters, per ft	12½ @ 25
Cherry, wide, per M	85 00 @100 00
Cherry, ordinary	45 00 @ 80 00
White wood, chair plank	60 00 @ 70 00
White wood, inch	25 00 @ 45 00
White wood, ⅝-inch	30 00 @ 45 00
White wood, ⅝ panels	35 00 @ 50 00
Shingles, extra shaved pine, 18-inch	9 50 @ 10 00
Shingles, extra shaved pine, 16-inch	8 50 @ 9 50
Shingles, extra sawed pine, 18-inch	7 00 @ 8 00
Shingles, clear sawed pine, 18-inch	6 50 @ 7 50
Shingles, cypress, 24x7	20 00 @ 22 00
Shingles, cypress, 20x6	12 00 @ 15 00
Lath, Cargo rate	1 35 @ 1 40
Yellow dressed pine flooring	25 00 @ 35 00
Yellow pine girders	30 00 @ 40 00
Locust posts, 8 feet, per inch	18 @ 20
Locust posts, 10 feet	24 @ 25
Locust posts, 12 feet	29 @ 34
Chestnut posts, per ft	3 @ 3½
Basswood per M	25 00 @ 30 00

Cargo rates, 10 per cent off.

BRICKS.

	Cargo.		Afloat.
Pale, per M.	2 87	@	3 00
Jersey	5 00	@	5 37½
Up Rivers	5 37½	@	5 75
Haverstraw Bay	5 75	@	5 87½
" " choice	6 00	@	6 25
Favorite Brands	6 50	@	6 75
Hollow Fire-Clay Brick	9 00	@	9 25

FRONTS.

Croton—Brown, per M.	7 00 @ 8 00
" Dark	8 00 @ 9 00
" Red	9 00 @ 9 50
Philadelphia	26 00 @ 28 00
Trenton	24 00 @ 29 00
Baltimore	34 00 @ 38 00

Yard prices 50 cents per M higher, or with delivery added $2 per M for hard and $3 per M for front brick. For delivery add $5 on Philadelphia and Trenton, and $6 on Baltimore brick.

IRON—PER TON.

Duty.—Bar, 1 to 1½c. per lb.; Railroad, 70c. per 100 lbs.; Boiler and Plate, 1½c. per lb.; Sheet, Band, Hoop and Scroll, 1¼ to 1¾c. per lb.; Pig, $7 per ton; Polished Sheet, 3c. per lb.; Galvanized, 2½c. per lb.; Scrap Cast, $6 per ton; Scrap Wrought, $8 per ton—all less 10 per cent. No Bar Iron to pay a less duty than 35 per cent ad val.

Pig, Scotch—Coltness	20 50 @ 21 50
" Glengarnock	19 50 @ 20 50
" Eglinton	19 00 @ 20 50
" American, No. 1	17 50 @ 19 00
" American, No. 2	17 00 @ 18 00
" American, forge	15 50 @ 16 00

	Store prices.		Cash.
Bar, Swedes, ordinary sizes	— 5	@	— 6
Bar, Swedes, nail-rod	— —	@	— 6½

LEAD—PER 100 POUNDS.

*German	— — @ — —
*English, common	— — @ — —
*Spanish	— — @ — —
*Foreign, refined	— — @ — —
*Bar	5 00 @ — —
*Sheet and Pipe	5 00 @ 6 00
*Domestic	3 37 @ — —

NAILS—PER KEG.

10d to 60d, common, fence and sheathing	2 30 @ — —
8d and 9d, common	2 85 @ — —
6d and 7d, common	3 10 @ — —
4d and 5d, common	3 35 @ — —
3d and 4d, light	4 10 @ — —
3d, fine	4 85 @ — —
2d, fine	4 85 @ — —
Cut spikes, all sizes	2 85 @ — —
Clinch nails, 1½ to 1¾ inch	5 00 @ 5 25
do. 2 to 2¼ inch	4 75 @ — —
do. 2¼ to 2¾ inch	4 50 @ — —
do. 3 inch and longer	4 25 @ — —

TIN PLATES.—Duty, 1 1-10 cents per pound.

*I. C. charcoal, 10x14, per box	6 25 @ 6 50
*I. C. coke, 10x14	5 00 @ 5 75
*I. X. charcoal, 10x14	8 25 @ 8 50
*I. C. charcoal, 14x20	6 50 @ 6 75
*I. X. charcoal, 14x20	8 25 @ 8 50
*I. C. coke, 14x20	5 00 @ 5 75
*I. C. coke, terne, 14x20	5 00 @ 5 25
*I. C. charcoal, terne, 14x20	5 50 @ 6 00

ZINC.—Duty, sheet, per lb., 2½ cents.

Sheet, (cask) per lb	— — @ — 6½
Sheet, (open)	— — @ — 7

SOLDERS.

No. 1	— 9 @ — 10
No. 2	— 8½ @ — 8¾

STONE.—Cargo Rates.

Amherst Freestone, in rough, per cubic foot	— — @ — 85
Berlin Freestone, in rough	— — @ — 95
Berea Freestone, in rough	— — @ — 75
Brown-Stone, Portland, Conn	1 25 @ 1 50
Brown Stone, Belleville, N. J	1 00 @ 1 50
Granite, rough	— 60 @ 1 25
Canaan Marble	1 25 @ 1 50
Dorchester, N.B., Stone, rough, per foot	— — @ 1 03

PAINTS.

*Carmine, American, per lb. gold	5 00 @ 5 50
Chalk, per lb	— 00¼ @ — 00⅜
China Clay, per ton gold	20 00 @ 22 00
Chrome yellow, dry, per pound	— 12½ @ — 28
Lead, red American, per pound	— 7 @ — 8
Lead, white American, pure, in oil	— 6½ @ — 8
Lead, white American, pure, dry	— 6¾ @ — 7¼
Lead, white English, pure, in oil gold	— 9½ @ — 10½
Litharge	— 7 @ — 8
*Ochre, Fr., dry, per 100 lbs	1 50 @ — —
Ochre, ground, in oil, per lb	— 6 @ — 15
Ochre, Vermont, per 100 lbs	— 75 @ 1 00
*Orange Mineral, English gold	— 9½ @ — 10
Paris White, American	— 1¼ @ — 1½
Paris White, English, prime	— 1¾ @ — 2
Paris Green	— 15 @ — 28
Plumbago paint, patent, per lb	— — @ — 25
Putty, per lb	— 1¾ @ — 2½
Spanish Brown, dry, per lb	— 1⅛ @ — 1¼
Spanish Brown, ground in oil, per lb	— 8 @ — 9
Venetian red, per cwt	1 75 @ 2 00
*Vermilion, Chinese, per lb	— 80 @ — 90
*Vermilion, Trieste	— 70 @ — 80
*Vermilion, quicksilver, bags gold	— 55 @ — 57½
Vermilion, American, common	— 15 @ — 18
Whiting, per 100 lbs	— 50 @ — 80
Zinc, white American, dry, No. 1	— 5 @ — 7½
Zinc, white American, No. 1, in oil	— 8 @ — 10
*Zinc, white French, dry, (Red Seal,) gold	— 8 @ — 8½
Zinc, white French, in oil gold	— 10 @ — 10½

VARNISHES—PER GALLON.

American Wearing Body	3 50 @ 4 00
Coach Body	2 35 @ 3 50
do do	1 80 @ 2 00
Furniture	1 25 @ 2 50
Black Asphaltum	1 00 @ 1 50
Brown Japan	1 00 @ 1 20
Liquid Paint Dryer	1 35 @ 1 75
Harness, (black)	3 00 @ 4 50
Shellac, Spirits	3 00 @ 3 50

CEMENT—PER BARREL.

Portland (imported)	2 75 @ 3 50
Portland (American)	2 50 @ 2 75
Roman	2 75 @ 3 25
Keene's, coarse	6 50 @ — —
" fine	10 50 @ — —
Martin's, coarse	6 00 @ — —
" fine	10 50 @ — —
Rosendale	1 00 @ — —

DEADENING AND ROOFING MATERIAL.

Mineral Wool for Roofs and Deadening, per lb. — 1¼ @ — 1½

HAIR.

Cattle, per bushel of 7 lbs	— 9 @ — 12½
Goat, " "	— 15 @ — —

SLATE.

Purple roofing slate, per square	$6 00 @ 7 00
Green slate	6 00 @ 7 00
Red slate	10 00 @ 11 00
Black slate, Pennsylvania, (at Jersey City)	5 00 @ 5 25
" " Cargo rate	3 25 @ 3 75
Slate tiles, 1¼-inch, rubbed, per square foot	20 @ — 25

PLASTER PARIS.

Duty.—20 per cent ad. val. on calcined; lump free.

Nova Scotia, white, per ton	2 90 @ 3 00
Nova Scotia, blue	2 80 @ 2 85
Calcined, Eastern and city, per bbl	1 00 @ 1 15
Calcined, city casting	1 20 @ 1 25
Calcined, city superfine	1 30 @ 1 50

LIME—PER BARREL.

State, common	— 60 @ — —
" finishing	— 80 @ — —
Rockland, common, cargo rate	— 50 @ — 55
" finishing	— 75 @ — —
Ground	— 60 @ — 65

Add 25 cents to above figures for yard rates.

FOREIGN WOODS.

MAHOGANY.

St. Domingo, crotches, ordinary to good, per ft	— 15 @ — 20
St. Domingo, crotches, fine	— 20 @ — 30
St. Domingo, logs, small	— 5 @ — 8
St. Domingo, logs, large	— 20 @ — 30
Frontera, Mexican, large	— 11½ @ — 16
Frontera, Mexican, small	— 8 @ — 10
Other Mexican	— 8 @ — 14
Honduras	— 10 @ — 15

ROSEWOOD.

Rio Janeiro, ordinary to good, per lb	— 3½ @ — 8
Rio Janeiro, good to fine	— 5 @ — 8
Bahia, ordinary to good	— 2 @ — 6½
Bahia, good to fine	— 4½ @ — 8
Honduras, per ton	10 00 @ 20 00
Satin Wood, per foot	— 15 @ — 60
Tulipwood, per lb	— 6 @ — 12½
Lignumvitæ, small, per ton	10 00 @ 20 00
Lignumvitæ, large	25 00 @ 50 00

CEDAR.

Cuba, per superficial foot	— 12½ @ — 16½
Mexican, small	— 8 @ — 10
Mexican, large	— 10 @ — 16
Florida	— 50 @ 2 00

DOORS, WINDOWS, AND BLINDS.

DOORS, RAISED PANELS, TWO SIDES.

2.0 x 6.0	1¼ inch.	$ 67 ——
2.6 x 6.6	1¼	— 95 ——
2.6 x 6.8	1¼	— 99 ——
2.8 x 6.8	1¼	1 04 ——

DOORS, MOLDED.

Size.	1¼ inches.	1½ inches.	1¾ inches.
2.0 x 6.0	$1 23	——	——
2.6 x 6.6	1 52	1 93	——
2.6 x 6.8	1 57	1 85	——
2.6 x 6.10	1 59	2 01	——
2.6 x 7.0	1 62	2 09	——
2.8 x 6.8	1 62	2 09	2 57
2.8 x 7.0	1 69	3 17	2 69
2.10 x 6.10	1 79	2 26	2 84
3.0 x 7.0	1 87	2 45	3 00

INSIDE BLINDS.

Per lineal foot, 4 folds, pine	04 @ — —
Per lineal foot, 4 folds, ash or chestnut	— 07 @ — —
Per lineal foot, 4 folds, cherry or butternut	— 08 @ — —
Per lineal foot, 4 folds, black walnut	— 10 @ — —

OUTSIDE BLINDS.

Up to 2.10 wide, per lineal foot	— @ —
Up to 3.1 wide	— @ —
Up to 3.4 wide	— @ —
Do. painted and trimmed	40 @ —

WINDOW FRAMES.

Up to 3.4 x 7.2, put together	2 30 @ — —

DRAIN AND SEWER PIPE.

(Delivered on board at New York.)

PIPE, per running foot.

2 inches diameter,	$0 13	10 inches diameter,	$0 70
3 "	0 16	12 "	0 80
4 "	0 20	15 "	1 25
5 "	0 25	18 "	1 60
6 "	0 30	20 "	2 00
7 "	0 35	22 "	2 50
8 "	0 45	24 "	3 00
9 "	0 55		

REVIEW OF THE MARKETS.—Business the past month has been very satisfactory, and fully up to all anticipations. Prices have advanced in some instances, and at this writing are firm. Supplies in hand have pretty evenly balanced demand, and only in rare cases have they been excessive. Taken altogether we find a very healthful tone prevailing, and the predictions for the remaining months of the year hopeful.

In the lumber market trade has progressed favorably and we have heard little or no complaint in regard to the same. Occasionally there has been grumbling because values were not up to anticipations, but this has been the exception, and has come only from that portion of the trade who appear to be always on the alert to bull the market and take no thought of the future. The great majority of the trade feel that the small margin they have accepted sustained the demand this season, which has already exhausted liberal quantities of dry lumber and promises to sustain the average to the close of navigation.

In the brick market values have taken an upward turn, while demand has been good and active from all quarters. This has not only exhausted but has anticipated supplies, and manufacturers have been unable to bring their production up to a point sufficient to meet current consumption. So difficult has it been at times to secure stock that some of the principal contractors were compelled to temporarily suspend work for want of brick.

In the lime market former figures have been generally named when quotations were asked, but the entire situation at the moment is nominal, and really no basis has existed for close rates. Stocks in yard have shown animation in some cases, but only small quantities have been ordered forwarded from primary points, either Eastern or State.

In the lath market there has been some irregularity, but the general undertone has been encouraging and the average tendency in buyers favor. The actual consumption of lath has now commenced, and as dealers see the impression made upon these accumulations they become more and more anxious for renewals of stock. Taken altogether the outlook is encouraging for the selling interest. Prices at the time we write are firm.

In the hardware market trade has been moderate, but is now on the increase, and dealers generally seem to feel encouraged. The changes made in the line of valuations have been few and of moderate character, with the average undertone steady.

In the paint market trade has been without animation, but showing a tendency to improvement, and dealers speaking more cheerfully.

In the metal markets, American pig has been in good and increasing demand; manufactured iron has been selling pretty well with prices tolerably well sustained; Scotch pig has shaded a trifle on cost, and this has induced an increased business. Domestic pig lead has been selling along quite uniformly and a good healthy market has been preserved at full former rates. Tin in pig has met with a slow jobbing demand, but no animation has been developed, and in some cases slight signs of weakness have been evident.

Dampness in Foundation and Cellar Walls.

By permission of the publishers, Messrs. Bicknell & Comstock, of 27 Warren street, this city, we take the following extract from an important work just issued by them, entitled "Foundations and Foundation Walls," the author of which is George T. Powell:

"In dwellings that are isolated, to avoid dampness from penetrating the basement or cellar walls that are below the line of earth, architects sometimes specify

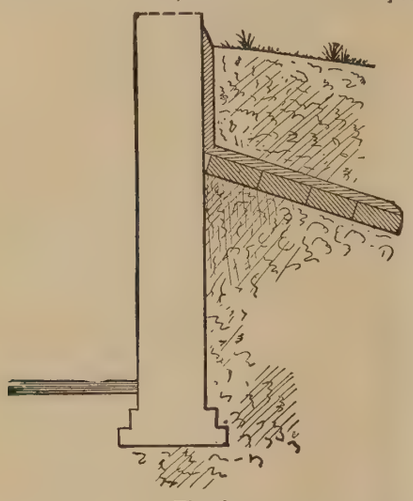


Fig. 1.

that the outside of the walls be cemented from the footings to the base-board of the frame-work, or the base line of the stone molding, and in some instances stop the cement from 4 to 6 inches below the line of earth. Then excavate the earth around the structure to the distance of 2 feet from the wall, and to a depth of from 16 to 20 inches; at an angle of 10° lay one course of brick flat up to the wall line, and cover with a coat of cement, as shown in Fig. 1.

"Before this is done, it is necessary to fill in earth and settle it around the walls. After this is done, allow it to set perfectly before covering with earth. As the foregoing method interferes with flowers and grasses up to the line of the wall, here is another method. (See Fig. 2.)

"After the wall has been built and cemented on the outside, (Rosendale cement is good enough), excavate

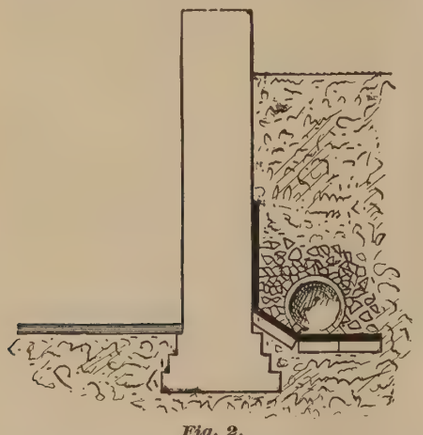


Fig. 2.

the earth on the outside to the line of footings, fill with firm earth to the top of the footings, and grade the excavation to a proper descent to carry the water to the sewer in a drain pipe, laid on top of a course of bricks cemented, on top of this put loosely broken stone, and cover the whole over with earth when it is dry. Where there is a clay bottom and much moisture, even this will not prevent dampness from arising in the cellar. To overcome this, use the method shown in Fig. 2 on the outside, and that of Fig. 3 on the inside.

"Prepare the cellar bottom, and lay say from 3 to 4 inches of sand, rolled down firm and even. On top of this put a coat of cement 1½ inches thick over the whole surface of the cellar, and lay off around the cellar walls in the cement flat gutters of slight descent to the sewer or waste pipe.

"There are clay soils sufficiently solid for walls of dwelling houses; but the clay in wet seasons retains so much moisture that it does not seem to be carried away into the earth, but rises and penetrates through the cellar bottom, and keeps the cellar damp nearly all the time. This is a serious difficulty to overcome, but the following method can be carried out with success, (see Fig. 3): Excavate the foundations to the depth required to put in the footings, and in the cellar bottom put 4 to 5 inches of sand rolled hard, on top of which lay a coat of cement not less than 1 inch thick, and when this is as dry as possible, put a coat of asphaltum over the whole surface up to the lines of the inside walls, and through one course of brick-work around the whole structure, care being taken to cement the outside wall and coat it with asphaltum, the same as the cellar floor. This is the best course to pursue where there is no chance for a drain.

"Another method to secure a dry cellar is as follows, (see Fig. 4): Perform such levelling to the cellar bottom as may be required; spread over this sand to the depth of 3 to 5 inches, and roll or pack firm on top of this; cover the whole surface with 1 inch of cement mortar, (Rosendale or American brands), and carry it well against the inside of the outer walls. Coat the outside walls with cement from ½ to ¾ of an inch thick in the same manner up to the dry line; then on top of this lay a coating of asphaltum, tar and sand, applied hot; carry the asphaltum through the wall, (this should be provided for when the foundation walls are being built)—see Fig. 3—and coat the outside wall to the dry line with hot asphalt. When the asphalt is sufficiently dry to walk on, dip heated brick into asphalt and tar, and lay closely the whole surface with brick-work. When it is not possible to carry the asphalt through the wall to the outside, carry it up on the cement on the inside, as shown in Fig. 4.

"The best mixture of asphalt is to mix with it 10 per cent of coal tar and 25 per cent of sand, and use while hot, to form a cement for bedding brick for damp cellar bottoms."

Cincinnati Industrial Exposition.

The Seventh Cincinnati Industrial Exposition will open September 10th and close October 11th. This exhibition will be held in the grand permanent buildings erected for the purpose, at a cost of one million dollars. The exposition is under the auspices of a Board of Commissioners from the Chamber of Commerce, Board of Trade, and the Ohio Mechanics' Institute, of which Edmund H. Pendleton is President, H. McCollum, Secretary, and John Simpkinson, Treasurer.

The excellent and liberal management of the previous expositions which have been held at Cincinnati, and the success which has attended them, are a sufficient guarantee that no expense or effort will be spared to make this, as it is intended to do, surpass in variety and magnitude all previous exhibitions held in this country, except the International Exhibition at Philadelphia in 1876.

The managers in their circular, state that, owing to the Centennial Exhibition at Philadelphia in 1876, and the want of suitable buildings, no exposition has been held in Cincinnati since 1875. Public spirited citizens have now, however, caused to be erected permanent buildings, which for spaciousness, architectural beauty, and general adaptation for exposition purposes are nowhere equalled in this country. In making the announcement of the opening of the exposition, the Board of Commissioners call the attention of exhibitors, manufacturers, and others to the fact that this exhibition is a public institution, guaranteed by subscriptions, and is in no sense a private enterprise or speculation. The management is gratuitous, and the amounts obtained from these exhibitions have been applied to the payment of extraordinary expenses, increased on account of the want of permanent buildings.

Arrangements for reduced fare have been made with the railroads radiating from Cincinnati. Arrangements have also been made for the cheap transportation of articles for the exposition from all parts of the country, and for their removal from the depots and wharves in the city, to the place of exhibition, safely and at low rates.

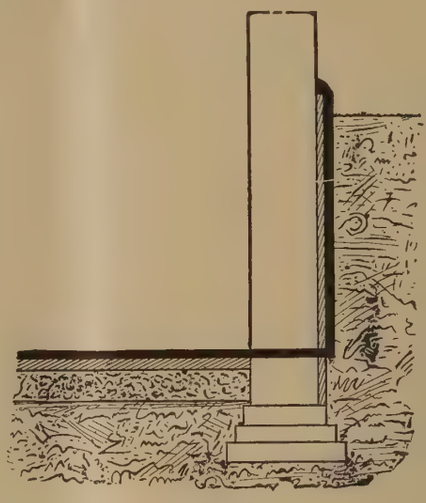


Fig. 3.

Over 1,000 gold, silver and bronze medals are to be competed for, in addition to cash premiums.

The Manufacture of Thimbles.

In the first place a lot of bright silver dollars, fresh from the mint, are put into crucibles and melted into solid ingots. They are then rolled into the required thickness, and cut by a stamp into circular pieces of the required size. These circular disks are placed under a solid metal bar of the size of the inside of the intended thimble which, moved by powerful machinery descends in a bottomless mold of the outside of the thimble, and presses the metal into the desired shape at a single blow.

The remaining operations of brightening, polishing

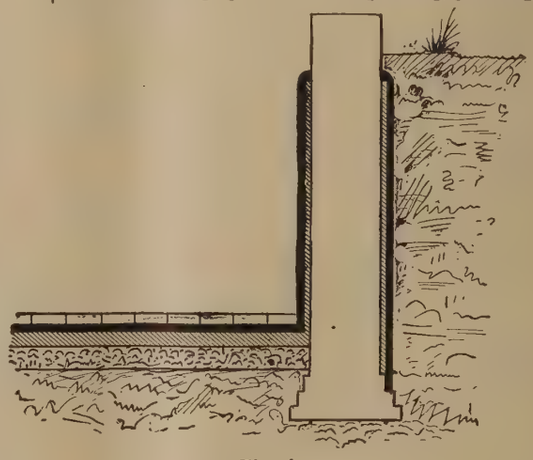


Fig. 4.

and decorating are performed by means of a lathe. First the blank form is fitted with a rapidly revolving rod; a slight touch of a sharp chisel takes a thin shaving from the end, another does the same on the side, while another rounds off the rim. The polishing is done by a round steel rod, which is dipped in oil and pressed upon the surface. Small revolving steel wheels held against the revolving blank pierce the indentations on the lower half and end of the thimble; the ornamentation is done by a similar process.

All that remains to be done to the thimbles is to brighten and polish the insides, boil them in soapsuds to remove the oil, brush them up, and pack them for the market.

Home Department.

The House Moth.

Of all the household pests the carpet moth, or the *tinea tapetzella*, is certainly the most powerful and persistent, and how to prevent its encroachments is a problem worthy of study. It extends its operations rapidly, taking possession of every nook and crany, and when it comes in contact with woolen goods or furs its appetite is simply voracious; carpet dealers suffer much from its ravages, and many a fine Moquet or Wilton which has been "shelved" for a season, on being brought to light is found to be utterly ruined. It is only by the most careful and frequent inspections, that carpet and furniture dealers are able to hold their own against their wily enemy; floors are thoroughly scrubbed, cracks and crevices are cleared of lint and filled with naptha, and so the warfare constantly goes on.

Those dealers who make a business of storing furs during the summer months, and who insure them against the ravages of the moth as well as from loss by fire, (the rate of insurance being five per cent on $100) pack their goods in camphor—an excellent preventative but useless as a cure. Valuable furs that are moth-infested are often sent to the "trader" to be worked over in sawdust and butter by the process employed in skin-dressing, and which has the desired effect in destroying the vermin.

Now the question arises, is there no exterminator in existence which we can apply to moth-ridden household articles generally? Of course in every case prevention is better than cure, and thorough cleanliness, yearly or semi-yearly beatings of carpets, frequent overhaulings of furniture, and the liberal use of camphor, will do much to rid our houses of these pests; but when they once have fastened themselves upon us with an evident disposition to stay, how are we to be saved from the destroyer?

Some relief for the afflicted may be found in the fact that some four or five years ago a cleansing process was discovered, which is called, the "naptha bath," and is thus described: A large tank, with a capacity of fifteen or twenty barrels of naptha, is filled with that fluid, and heated at 130° by the introduction of a steam coil. Into this the articles to be cleansed are plunged and allowed to remain four or five hours; when taken out not only has every perceptible vestige of the moth disappeared, but any minute larvæ which the article may have contained is effectually destroyed. Sometimes cold naptha is used in this process, but the time required for the operation is much longer.

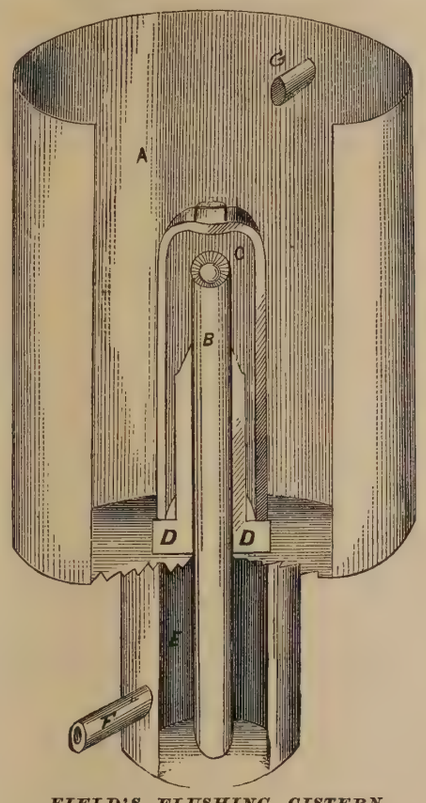
By this process, which seems to answer in every particular the purpose for which it is intended, the finest fabrics are not injured in the slightest degree. Several concerns are engaged in the naptha cleansing business in New York, Boston and Chicago, and will undertake anything from a fur muff to a set of furniture, at prices ranging from twenty-five cents to twenty-five dollars.

Care of the Eyes.—The care of the eyes is urged by Arthur Chevalier in a new French work. The use of the eyes, he says, should be regulated by their strength, and they should never be overtaxed. A habit of resting them often during work is recommended. Thus in reading or writing stop from time to time and allow the eyes to wander over surrounding objects. To persist in working after symptoms of fatigue appear is foolish. As soon as the eyes begin to itch, or grow red, or any pain is felt in the eye-balls, work should be discontinued and cold water applied. Do not pass suddenly from darkness into bright light. All artificial lights are injurious. The author adds:

"If a person cannot tear himself away from close work, he can at least vary his occupation. Let him close his eyes from time to time, and take a turn around his room, or what is better, take a walk in the fresh air; this, even if it be but for a few minutes only, will do him a great deal of good. Let him who once becomes convinced that he is putting too much confidence in his eyes take care to abstain from all confining work immediately after rising, after meals, or by artificial light. Let him wash his eyes often during the day with cold water—a remedy which, although simple in itself, never, fails in every case to produce good effects. Baths of tepid water are injurious to the eyes."

Flush Tanks.

Any one acquainted with the small amount of water habitually discharged into the sewers from private residences, knows that its motion is so slight that it has a continual tendency to deposit sediment and to promote parasitic vegetable growth, with their inhabitants, the bacteria, one of the lowest classes of animalcula—always present where putrefaction takes place in largely diluted organic remains, and in localities where zymotic diseases prevail. The best way to get rid of conditions favorable to these injurious agencies, is to have periodical floodings and scourings, using large amounts of liquid—say some 20 pailfuls, which, if discharged in



FIELD'S FLUSHING CISTERN.

a volume, will effect a thorough cleansing of the pipes, and part of the sewers they are connected with.

The purpose of the flushing cistern here represented is to effect such a scouring periodically in an automatic manner. It may take the water and any liquid refuse matter from 1 to 20 hours to collect; by the siphon arrangement it will, as soon as a certain hight is reached, be discharged with a rush in 20 seconds—an operation repeated every time the contents ascend to a certain level, which may be one, two, three or four hours. The effect of this sudden discharge is that the whole line of pipe is thoroughly scoured and cleansed from impurities, which, if allowed to remain and dry on the inner surface of the soil pipe, would be liable not only to generate sewer gases of a most deadly nature, but also to eat holes of a minute character, which if they would not allow a water leakage, would admit streams of gas into the apartments through which the pipe passes. All waste waters contain acids, and it is these that so rapidly eat away whatever metal they may be exposed to for any lengthened period. By frequent flushing, pipes may be made as cleanly as the wash-bowl that contains the supply and washes it.

As explanatory of the engraving, we may add that G is the supply pipe, by which the waste water enters the flush tank A, made of sheet-iron; C and B in combination constitute a siphon, in which D D are the seats for the short leg; the ascending tube D C surrounds the descending tube B. As soon as the water reaches over the top C of the lattice, it will rush down, carrying with it the air in C, while the vacuum there created will cause the liquid in the tank A to ascend from D to C, and descend furiously through B, and continue in its motion until the tank A is empty. Running into E below, it finds its exit by the tube F to the sewer. As E is hermetically closed, no odors can ascend from it, or from the sewer, with which it is connected by F. The whole apparatus, therefore, acts as a perfect trap, and it would be desirable to have it adopted in all houses connected with sewers.

This flushing cistern was patented by Rogers Field, and can be obtained at Jennings' Sanitary Depot, 94 Beekman street, New York, A. G. Myers manager.

Is Fat Injurious?

Fats are very important elements of our food; still, goose oil, lard, tallow, train oil, fish oil, and like varieties of diet, are wisely eschewed by all except lumbermen, and those whose physical labor is very great, and who are almost constantly exposed to cold. While, therefore, the student and civilized worker wisely eschews the coarser forms of fat, he should not ignore it in some more refined and delicate form; he should instead use such fats as are most suitable to his taste and needs. The brain is a great consumer of fat, combined with phosphorus. "No phosphorus—no thought," is a modern phrase, expressing the importance of phosphorus in mental action. As yet we are in the infancy of knowledge on this subject, but it may be predicted that when we know the whole truth, the phrase will be something like this: "No phosphorized fat, no thought." There is always some fat in most of our foods. The special forms best to make up any deficiency that may be in them are no doubt to be found in good butter and cream; there are, of course, instances in which they will not be tolerated, but these are exceptions. Fat is not digested in the stomach, but by the pancreatic juice in the intestines, nature having provided a special juice to form it into an emulsion so that it may be absorbed. In this state every atom of fat is so small that it requires a microscope to detect it, and in this state it may easily be passed through the walls of the intestines and carried into the circulation. We require no better evidence of the need of fat than this careful provision for its digestion in the system. The symptoms which attend a non-use of fats in some form are coldness of the extremities, a tendency to indigestion, lack of nervous energy and power to think, emaciation, diminished muscular power, and a tendency to consumption.

It may be true that many persons suffer from an inability to digest fats, and that sometimes they obstruct the liver and cause much trouble. In all cases it would be advisable to use them wisely and judiciously, but rarely to avoid them altogether, except perhaps in corpulency, where they are best used in great moderation. Lean people should use fats rather more freely than fat ones. The amount of fat necessary for a healthy working person is about three ounces daily; persons with extraordinary working power require more than this. The starch in our food is to a certain extent a substitute for fat, and may be converted into it.

The Influence of Temper on Health.—Excessive labor, exposure to wet and cold, deprivation of sufficient quantities of necessary and wholesome food, habitual bad lodging, sloth and intemperance, are all deadly enemies to human life; but they are none of them so bad as violent and ungoverned passions. Men and women have survived all the former, and at last reached an extreme old age; but it may be safely doubted whether a single instance can be found of a man of violent and irascible temper, habitually subject to storms of ungovernable passion, who has arrived at a

very advanced period of life. It is, therefore, a matter of the highest importance to every one desirous of preserving "a sound mind in a sound body," so that the brittle vessel of life may glide down the stream of time smoothly and securely, instead of being continually tossed about amidst rocks and shoals which endanger its existence, to have a special care, amidst all the vicissitudes and trials of life, to maintain a quiet possession of his own spirit.

How Typhoid Fever may be Propagated.

In a recent number of the *Popular Science Monthly*, Ely Van De Warker, M.D., of Syracuse, N. Y., under the title "Typhoid Fever Poison," reports seventeen cases of the fever in an isolated suburb of the city in which there were but fourteen houses. The first case was imported; thence through the overflow of the privy in which all the excrement of the patient had been thrown, a well became contaminated. All the persons who were taken ill used this well. It was the constant or occasional source of supply of seven of the fourteen families. No cases occurred in households where the inmates did not use this well. Some cases were developed in every family who drew water from it. The families who escaped were exposed to every other influence but that of this particular well; their own water supply was the same, less the privy contamination. It is not unlikely that their own wells received some of the overflow from their own vaults, but as these were free from typhoid poison, no ill results ensued.

About eight years since, Dr. Flint, who has studied and written a great deal on the subject, became satisfied that a source of typhoid fever existed which was little dreamed of, and which at first thought would seem impossible. This source, as he then enunciated it to his home medical society (and not to his knowledge having been before suggested), is found in ice. If this idea is thoroughly investigated, it will not appear to be very problematical. In the first place, the poison is not destroyed or impaired by freezing (some one long ago remarked that ice often masks or conceals what it does not kill). Now, whence comes our ice supply? Often from shallow reservoirs in the midst of neighborhoods of large towns purposely made to receive surface drainage from all around, under the erroneous idea that no harm will ensue, as freezing is supposed to purify and render harmless what might otherwise be objectionable. Great quantities of ice are taken from canals, from creeks, from stagnant ponds, and from streams that are either the natural or artificial recipients of surface drainage, of the outpourings of sewers, and of uncleanliness from various sources. The danger from ice taken from improper places is not only from that which is drunk, but from its use in refrigerators and preservatories, where milk, butter, fruits vegetables and meats are subjected to its saturating influences as it vaporizes. Several instances have fallen under the doctor's observation where the disease, by the most careful investigation, could not be traced to any other source; and if we accept as a fact the statement positively made by Budd in the London *Lancet*, in July, 1859, that it never originates *de novo*, but proceeds from a special and specific poison which is capable of diffusion to a great extent, and which preserves its noxious qualities for a long period, even if buried for many months, we cannot reject the hypothesis of ice infection; and it is hoped that it will be made the subject of very thorough and careful investigation.

The Sun Cholera Mixture.—Many years ago the New York *Sun* published the following formula, which has proved so successful that it received the above name and has since been kept for sale in the drug stores under that title. It is probably one of the best remedies for summer complaint ever prepared. Take equal parts of tincture of Cayenne pepper, tincture of opium, tincture of rhubarb, essence of peppermint and spirits of camphor. Mix well. Dose: 15 to 30 drops in a little cold water, according to age and violence of symptons, repeated every fifteen or twenty minutes until relief is obtained. Taken in time it will prevent cholera, and is a sovereign remedy for colic, diarrhœa, dysentry, etc It is a simple, cheap remedy, and ought to be kept in every household.

The "Mechanic."

We are indebted to the *Mechanic*, an admirable journal published by the H. B. Smith Machine Co., of Smithville, N. J., for a very complimentary notice of our July number, which contained the exposé of Stover's pretensions. While thanking our contemporary, we desire to say a few words with reference to itself. The *Mechanic* is a monthly journal, devoted to mechanics, science, and general literature, and is very ably edited by Mrs. A. M. Smith. It is a highly useful publication, and contains a great variety of instructive matter; much of this is original, while the selected portions show very intelligent discrimination. We are glad to state that the *Mechanic* intends to republish the Stover article in full, including the illustrations that appeared in our July issue.

Miscellaneous and Advertising.

New Patent Paper Boxes as applied to all wrapping purposes. Send for sample, stating size, to Wm. Meschenmoser, 120 William street, New York.

The York Manufacturing Company, at Saco, Me., is about to build a library for the use of its operatives, at a cost of $13,000. This is an example worthy of imitation.

We call attention to the card of Livingston & Co., of Pittsburgh, Pa., in our advertising columns. This firm manufacture light gray iron and brass castings, and are prepared to execute promptly all orders they are favored with.

Packing paper may be made water-tight by dissolving 1.8 pounds of white soap in one quart of water, and in another quart 1.8 ounces of gum arabic, and 5.5 of glue. The paper is soaked in the mixture and hung up to dry.

According to a trade paper, 147,000,000 bottles of champagne were exported from France during the ten years between 1867 and 1877. The cultivation of the vine in France extends over more than 4,800,000 acres, the mean annual production of wine being about 20 quarts per acre.

The new Imperial Telegraph Office of Berlin is a very fine structure, admirably appointed. The underground telegraphic system, now nearly completed, has been attended with great cost and difficulty. The cable had, in places, to be embedded in rock or morass, deposited in rapid rivers, and carried beneath the walls of fortresses. Germany has now 4,115 telegraph offices.

A centennial history of Fall River, although published only three years ago, already needs revision in the part devoted to extravagant praise of "our old families." These families are five in number, and members of three of them are now in State prison, or under indictment, as thieves. George B. Durfee, who confessed stealing $35,000 from the Mechanics' Mill Company, is the latest to be exposed.

Messrs. Goodell & Waters, of 1507 Pennsylvania avenue, Philadelphia, produce machines in the woodworking line for planing mills, railroad shops, carbuilders, cabinet, carriage, sash, door, and blind makers. The expansion of their business by the purchase of the works of E. C. Tainter & Co., has increased their facilities to a very considerable extent, and they are able to turn out orders for any of their machines at the shortest notice.

A French inventor has recently proposed a perpetual clock, based on the difference of atmospheric temperature by day and by night. The heat of the day causes a liquid to rise in a reservoir, whence it falls by gravity, so operating the mechanism. This is a very old idea. More than twenty years ago we saw a form of perpetual clock in New York which was wound by the diurnal rise and fall of a column of oil.

Inspection of Boilers.—No inspection of boilers is complete without knowing what pressure has been carried. Such information can be had—for the benefit of the "Hartford" and other companies, as well as the steam users—by supplying themselves with the Edson "Recording Pressure Gauge," and explosions can certainly be avoided by the use of the "Electrical Alarm Apparatus," which can be attached to any gauge. For pamphlets and prices, send to M. B. Edson, President, 91 Liberty street, New York.

A Cheap Double Cottage.

The plans and elevation on the opposite page represent a design for a convenient and substantial double dwelling to be erected in the suburbs. It not only fills the requirements as a home for people of moderate means, but is an inducement to capitalists as an investment, which would yield a net return on the expenditure of from seven to ten per cent.

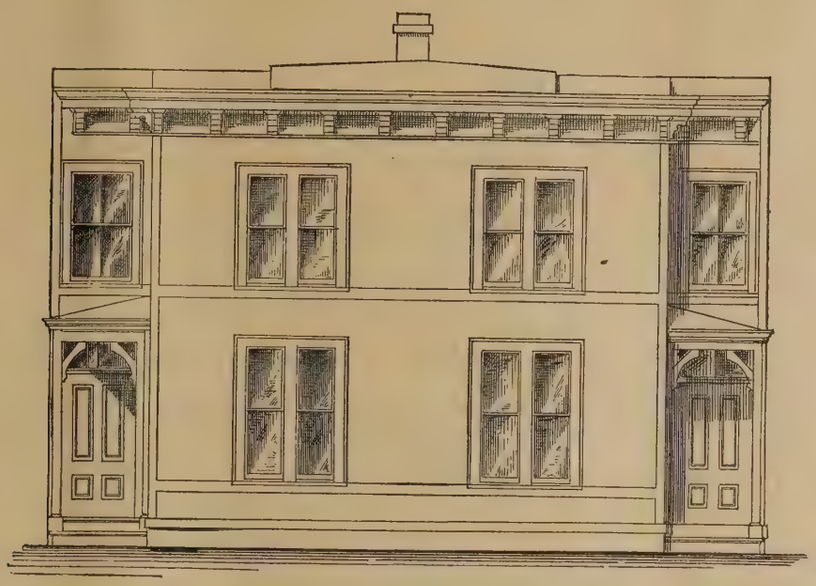
In these days of quick transit the growing demand for low priced tasty cottages in the suburban towns is a matter to which we have devoted much space, as our back pages bear ample testimony; we are glad to endorse or further any scheme which aims to advance the welfare of our citizens, especially this one of cheap, healthy and convenient homes. The man of family and limited income, in order to secure the desideratum of cheap rent, is compelled to go to the towns and villages, convenient to the city, where he also enjoys pure air as well, which, alone, is an inducement—or ought to be. The double plan we have adopted, in an economical light, possesses the advantage of less cost to erect together than if detached; at the time same they are entirely private, each having its separate entrances and yards. The entire frontage is 36 feet, thus giving a 7-foot light-space and passageway at each side if built on a lot 50 feet front. This side passage is a feature not often secured in a city house, and will therefore be appreciated.

The stoop is recessed from the street, thus giving more privacy to the entrance. The hallway leads to both parlor and dining-room, which are of liberal dimensions and connected by sliding doors—a feature, by the way, valuable in a small house, economizing room. The kitchen is in an extension at rear communicating with dining-room; these rooms have access direct to yard and passage at side, as will be seen on reference to the plan. Closets with shelves in both these rooms. Neat mantels in parlor and dining room. Cellar 6½ feet high under main building, reached by stairs from hall, and stone steps from rear yard. Hight of first story is 10 feet; second floor contains four good sized bed rooms and three closets, and is 9 feet high. A roof scuttle with step ladder is provided. The kitchen extension and main roofs are of tin. The floor beams are spruce; studding, hemlock; outside finish, white pine; all clear, well-seasoned stock. The customary sheathing, and narrow pine clapboards over it, are used for the outside; bands run across on line of window sills. Exterior blinds to all windows. The inside and outside work to have three good coats of white lead paint, the finishing coat of a pleasing tint, and trimming to match of a darker shade.

This cottage was erected several years ago at a cost of under $1,800.

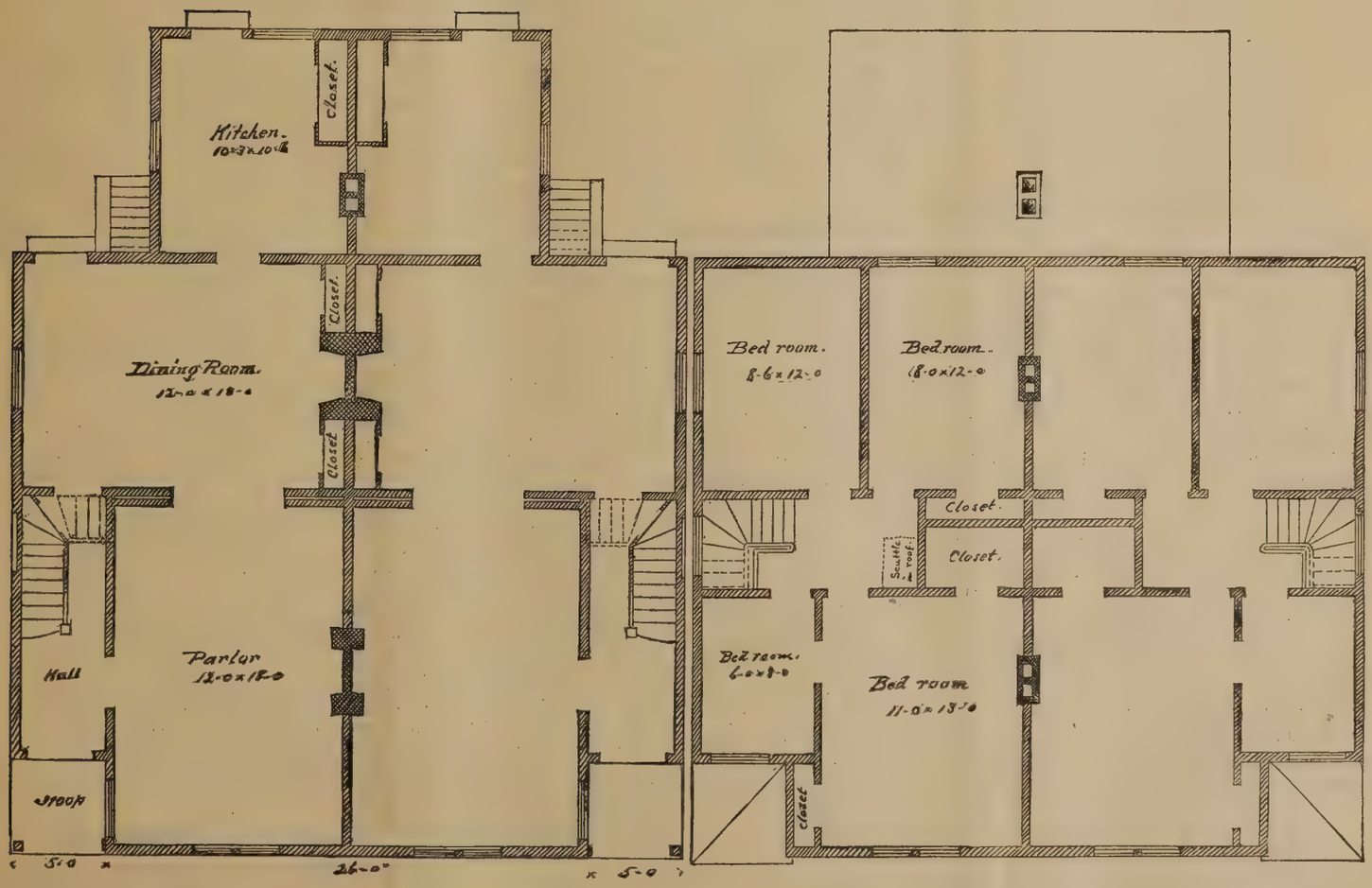
At the present prices it would approximate to $1,900, at which figure its cost may safely be taken. For the accommodation given, convenience of arrangement, neat appearance of the exterior, and total cost of the whole, this design will rank very high as giving the maximum of comfort for the least expense.

This plan was designed by Mr. Clarence M. Morgan, architect, of 160 Fulton street, New York, to whom inquiries regarding the same may be addressed.



FRONT ELEVATION.

Scale—⅛ Inch to the Foot.



FIRST STORY. SECOND STORY.

DESIGN FOR A DOUBLE COTTAGE, COSTING ABOUT $1,900.

Chronological Account of Some Early American Inventions and Enterprises.

1736.—The first steam engine built, after the Newcomen type, for the Schuyler copper mines.

1772.—Another similar engine, made for a factory in Philadelphia.

1785.—Oliver Evans, of Philadelphia, introduced steam power to drive a flour mill and a brick yard.

1785.—James Rumsey propelled a vessel on the Potomac river by the reaction of the water.

1787.—Perkins invented a nail cutting machine, which could make 200,000 nails per day.

1788.—John Fitch navigated the Delaware river with the first steamboat.

1794.—Whitney's cotton gin invented.

1796.—Benjamin Thompson, otherwise Count Rumford, discovered that there is no such thing as a caloric fluid, but that heat is a peculiar mode of motion of the material particles of bodies, and thus laid the foundation of the modern theory of the conservation of forces.

1797.—Benjamin Thompson invented a brush-making machine.

1797.—Amos Whittemore introduced a machine for making the cards used in cotton and woolen manufacture.

1798.—Robert McKean patented the first steam saw mill.

1799.—Oliver Evans, of Philadelphia, made the first high-pressure steam engine, and built a steam carriage, which however was not a success.

1804.—Col. John Cox Stevens invented the screw propeller, the model of which is still at the Hoboken (N. J.) Institute for Engineers.

1804.—Oliver Evans built a paddle-wheel steamer, to ply on the Delaware and Schuylkill rivers, driven by a double-acting, high-pressure engine; also adapted for land conveyance.

1806.—Thomas Blanchard, of Massachusetts, invented a tack-making machine, which made 30,000 tacks per hour.

1807.—Thomas Blanchard made an apparatus adapted for rifling gun barrels.

1807.—Robert Fulton travelled with his first steamboat from New York to Albany.

1807.—Oil-cloth for floor carpeting first made in Philadelphia.

1807.—John Bedford invented and manufactured metal-bound boots and shoes.

1811.—John H. Hall, of Massachusetts, invented breech-loading muskets.

1812.—George Shoemaker sold in Philadelphia several truck loads of anthracite coal for fuel, and was imprisoned as an imposter for selling stones for coal.

1813.—Francis C. Lowell made important improvements in the power loom.

1817.—George Clymer produced the first American-made printing press.

1818.—Jacob Perkins introduced steel engraving as a substitute for copper.

1819.—The "Savannah" made the first passage across the Atlantic ocean by steam-power driving paddle wheels.

1820.—Henry Burden, of Troy, N. Y., invented the cultivator.

1821.—The same invented improved rolling mills.

1821.—Jordan L. Mott invented utilization of small coal for furnaces.

1822.—James McDonald, of New York, invented machinery for cleaning flax and hemp.

1823.—Joseph Saxton invented a wheel-cutting engine, producing epicycloidal teeth.

1824.—Ladoc Pratt established his celebrated tanneries in the Catskills, New York State.

1824.—Completion of the Erie canal, connecting the large lakes with the Hudson river.

1826.—Harrison A. Dyar established the first telegraph line on Long Island, making signals with frictional electricity.

1827.—John McClinter, of Pennsylvania, invented the slotting and shaping machine.

1828.—First American patent for improvements in locomotives granted.

1828.—First locomotive journey made on the Honesdale and Carbondale railway, Pennsylvania.

1828.—Hay and straw used for the first time to make paper.

1828.—James Bogardus invented the ring-flyer for spinning cotton.

1829.—The same invented mills with eccentric grinding surfaces.

1831.—Redfield published his book on the theories of storms.

1832.—James Bogardus invented a dry gas meter.

1834.—Henry Burden invented his nail-making machines.

1836.—James Bogardus invented a pantograph.

1840.—The same invented the molds to press glass in while blowing.

1841.—The same made improvements in drilling machinery.

Since then inventions and patents have succeeded one another at a most astonishing rate.

Snowballing in July.

A very novel spectacle was witnessed in this city last month at Morrisania, where people were snowballing each other with genuine fresh snow, pressing it into big round balls, pelting each other with it, and slapping their half-frozen fingers on their thighs to restore circulation to the benumbed members. It was, of course, artificial snow, and made by the working of an ice machine just set going in J. & L. F. Kuntz's brewery.

The machinery, as usual in all ice machines of this class, consists of three parts—a compressing pump, a condenser, and a refrigerator. Aqua ammonia of the highest procurable strength is poured into a small still and heated until the ammoniacal gas is all driven off into the condenser. There, by the compressing pump, it is liquefied, at a pressure of 6½ atmospheres in a temperature of 50° Fah. The liquid gas is passed thence, through small tubing, into the refrigerator, which is a separate close chamber about 14 feet square; this chamber is the freezing-box for the whole brewery. The refrigerator itself is a voluminous machine, consisting of 8 coils, each 300 feet in length of continuous welded pipe, the whole forming a large cylinder 9½ feet in diameter. In these coils of pipe the gas, liquefied under pressure, re-assumes its gaseous form, and in so doing takes up all heat about it. The cylinder is kept whirling swiftly, partly to promote the spread and expansion of the liquid, but more to enable a lot of huge brushes to sweep off constantly the snow which is continually forming from the atmosphere upon these pipes. A cart-load of snow is thus swept off every day. But it is not nice snow. It is good enough for snowballs, but there its use stops, for the air from which it has been formed has been sucked up by a powerful draught from the depths of the lowest cellars, and every sour smell or taint in the atmosphere is transferred to this snow. The air driven down to replace that thus drawn up, is not only freezingly cold, but is dry and pure, so that through all the vaults the atmosphere seems like that of the country on a winter's morning. After going through this great mass of tubing, the gas returns to the outer chamber, bearing with it all the heat it has taken up; and to get rid of this it is sent through 1,200 feet of piping, upon which water falls in a spray, and a great fan keeps up a constant cooling current of air. After that it is fit to pass into the condenser, and so around again. None is wasted; none escapes. Yet it maintains a temperature of 3° Reaumer (say about 38° Fah.) throughout three vaults, each 80 × 50 feet, with an average hight of 11 feet, and even greater cold could readily be obtained were it desirable. The use of this apparatus enables the actual storage at one time of 50,000 barrels of beer.

It is claimed for the invention that it will save brewers a vast sum by diminishing the consumption of ice, and doing away with the necessity of constructing underground vaults of large dimensions.

New Publications.

How to Grow Handsome; or, Hints Toward Physical Perfection. By D. H. Jacques. New Edition. S. R. Wells & Co.

This new edition of a book claimed to contain "the philosophy of human beauty," is marred by old, coarse, and badly designed wood-cuts, which, instead of representing human beauty, are caricatures on mankind, especially of the female portion. It is incomprehensible to us, that in the present condition of art in this country, and the proofs given of it every day, even in the monthly magazines published by the Harpers, the Scribners, and others, that any publisher dares to place before the public such inferior, old, and miserable wood-cuts—cuts which would have escaped criticism fifty years ago, when our people were little educated in art, being unfamiliar with better productions, but nowadays should rather be left out altogether than printed as a proof of the deficiency of the publishers in artistic culture and their utter ignorance of art.

The subject of the book is of more importance than the general public is inclined to accede to it, and its treatment shows knowledge and talent, and if, instead of sticking in the old cuts, which the publishers have used over and over again in their publications on physiology, phrenology, gymnastics, and in their phrenological and water-cure journals, they had gone to the expense of having proper talent engaged to make new, good, and artistic engravings to illustrate the main points of the book, its sale would certainly be much greater from the attractiveness of the book, and would pay them better in the end, because as it is now, the book is repulsive to the artistically cultivated.

Drafting Instruments and Operations. By S. Edward Warren, C.E. New York: John Wiley & Sons.

This second revised and enlarged edition of a highly useful text-book for schools, classes of artisans, and for self-instruction, is divided into four parts. The first treats of the instruments and materials, the second describes the fundamental operations, the third plane problems and practical exercises, and the fourth explains the elements of taste in geometrical drawing.

We unhesitatingly recommend this book, the author being favorably known as a late professor in the Rensselaer Polytechnic Institute at Troy, N. Y., the Massachusetts Institute of Technology, and the Boston Art Normal School. He is also known as the author of a complete series of text-books on descriptive geometry and instrumental drawing. This work comprises 152 pages, and is illustrated with 7 large lithographic plates, containing 80 figures.

Transactions of the American Institute of Mining Engineers. Vol. VI. Easton, Pa.: Published by the Institute at the Office of the Secretary, Lafayette College.

We always welcome this periodical publication as a record of the transactions of one of the most vigorous associations in the United States. The mere titles of the papers published in this volume show how fully the members are aware of the exigencies of the times. Thus we find a paper by Prof. Richards, of the Technological Institute of Boston, on a "Mining Laboratory;" "The Problem of Transmitting Power in Large Amounts by Electricity," by N. Keith, of Newark, N. J.; also papers on "Hydraulic Mining in California," "The Manufacture of Iron in Mexico," "Methods of Mining on Lake Superior," "Electrolytic Deposits of Copper," etc. In short, the volume abounds in highly interesting and instructive matter.

Foundations and Foundation Walls. By George T. Powell, Architect and Civil Engineer. New York: Bicknell & Comstock.

This book contains information in regard to the construction of foundation walls for all kinds of buildings, on pile driving, building stones and bricks, pier and wall construction, mortars, limes, cements, concretes, stuccos, etc. Also tables of weights of materials, the kinds of materials used, loads sustained, sizes of walls, piers, etc., with extracts from the New York building laws. To this is added a valuable contribution from Frederick Baumann, architect, in relation to the method of preparing foundations and of building isolated piers as practiced in Chicago. The book is illustrated with 60 wood-cuts, and deserves commendation.

The Mechanic. A Weekly Journal of Mechanics, Science and Literature. Published by the H. B. Smith Machine Co., at Smithville, Burlington Co., N. J.

It is far from us to underrate or depreciate a competitor occupying almost the same field as our own journal, in case that competitor shows talent and an honest desire of being useful to the circle of readers to whom it has attained access. The above mentioned journal is of a class which we can only praise; its columns are filled with useful information, and it appears to enjoy a liberal advertising patronage. We recommend it to all who wish to procure a cheap industrial weekly, its price being only $1 a year.

OTHER PUBLICATIONS RECEIVED.

"Rules, Regulations and List of Premiums of the Deseret Agricultural and Manufacturing Society," for the Fourteenth Exhibition in Salt Lake City, Utah, commencing on the first day of October, 1879. Salt Lake City: Printed at the Herald Job Office.

"Seventh Cincinnati Industrial Exposition of Manufactures, Products, and the Arts." Rules and Premium List. 1879.

Notes and Queries.

This department is intended to furnish, for the benefit of all our readers, information on any subject of scientific or practical knowledge falling within the field of The Manufacturer and Builder. *All persons possessing additional or more correct information than that which we give relating to the questions, are cordially invited to communicate it to us for publication. We also request that all questions or answers be written on separate pieces of paper, and addressed to the Editor.*

QUESTIONS.

(2429) Electricity as a Motive Power.—Have you not always been teaching that it was absurd to attempt the use of electricity as a motive power, on account of the great expense of electric batteries as compared with steam generators? How is it then that, as the papers report, plowing by electricity is now being introduced very successfully in France? Please explain.—One of Your Old Cooper Institute Students, New York City.

(2430) Anti-Moth Wrapping Paper.—What is the nature of the wrapping paper which has lately come into use for preserving furs and clothes against moths?—D. T., Holton, Ind.

(2431) Imitating Mahogany and Walnut.—Will you please give a recipe for making and using a stain to imitate walnut or mahogany.—J. J. M., Second Creek, W. Va.

(2432) Horse-Power Needed on Inclines.—Will you please inform me what power of engine is required to elevate, including its own weight, 35,000 pounds up an incline of 7 inches to the foot. It is intended to use a center cog rail, and the driving cog will not exceed 12 inches in diameter. The speed will be about 60 feet per minute.—M. T., Hamilton, Canada.

(2433) Record of Letters Sent.—Will you be kind enough to inform me of the best method of keeping a record of the letters I send out. I have tried several ways, but as yet none of them have seemed to be just what I want. I mean a record besides the copying-book—one that will show the date of each letter, to whom written, the subject, and the date on which the answer is received.—F. T. S., St. Louis, Mo.

(2434) Straightening Crooked Noses.—I have heard of an instrument, invented I believe in London, for the purpose of making crooked and deformed noses straight and comely. Please give me any information you may possess in regard to it, and also your opinion as to the merits of such an appliance.—A. F. P., New York City.

(2435) The Longest Tunnel.—Is there any tunnel longer than the Sutro, the Mount Cenis, or the St. Gothard tunnels?—G. H., Shell Rock, Minn.

(2436) Patents on Feed-Water Heaters.—Is the use of coiled pipes under steam boilers, for heating water, protected by patent?—F. W. B., Bloomville, O.

(2437) Jet Pump.—Is the jet pump protected by patent? Who was the inventor of it?—F. W. B., Bloomville, O.

(2438) Power Transmitted by Belts.—Will you please give a rule by which I can ascertain the amount of power transmitted by a belt of the average thickness and 4½ inches wide, and which, unless very tight, slips on the pulleys. The latter are of the following sizes: Driving pulley, 22 inches; driven pulley, 16 inches. What is the price charged for 1 horse-power per day—say from 1 to 6 horse-power? In case of an accident that may cause stoppage, are those furnishing the power liable for damages?—L. & T., Hamilton, Canada.

(2439) Will the Panama Canal Pay?—Can it be reasonably expected that the Panama canal will pay those who invest their money in its construction? It is no doubt a highly useful enterprise, but is it not to be feared that the stockholders will lose a great deal of money by it for the benefit of those who are to use the canal?—A Small Capitalist, New York City.

(2440) Reckoning Dates in Remote Parts of the World.—When a ship sails around the world westward it loses a day—that means, when coming home from the east it is, in its reckoning, a day behind; and when sailing eastward it gains a day, and on reaching home it is a day ahead of the reckoning of the people who remained at home. This is plain enough, as in the first case it sails with the sun and makes one revolution around the earth with the sun, and in the second case, sailing against the sun, it has one day more. But what I want to know is, at what longitude must the difference be made up? Of course we count the same as Europeans. How is it with Asia?—A Teacher, Brooklyn, N. Y.

(2441) Chemicals for Hydro-Oxygen Light.—Will you be kind enough to give me the names of the chemicals used in making the hydro-oxygen light for a magic lantern, and how used.—W. D., Tooele City, Utah.

(2442) Sawyers' Technical Terms.—Please explain the terms used by sawyers, who speak of their mills being "round gang," "live gang," "slabbing gang," "pony gang," and "saddle slabbers."—F. D., Utica, N. Y.

(2443) Japanese Spheres of Rock Crystal.—How can I best ascertain whether a globular piece of clear crystal has been ground of glass, or whether it is a real Japanese pebble? Can you inform me how the Japanese make those beautiful balls?—An Optician, Cincinnati, O.

(2444) Paint for Rusty Iron.—Please inform me what kind of paint to use on iron that is always damp, to prevent rust?—F. M. S., Newark, Ohio.

(2445) Steaming Wood.—What is the proper pressure of steam in steaming wood for chair stock, etc.? How long should the stuff remain in the steam box?—R. G., Sydney, Nova Scotia.

(2446) Teacher of Penmanship.—Who is the most successful teacher in penmanship?—Teacher, East Saginaw, Mich.

(2447) Cure for Pimples.—Is there anything that will remove black worms and eruptions from the face? Will sulphur, or sulphur soap, accomplish this?—J. L., New York City.

(2448) Ohm, Volt, and Weber.—What is the meaning of the three terms Ohm, Volt, and Weber, used as units by electricians?—G. T., Brooklyn, N. Y.

(2449) The Lake Superior Copper Mines.—How long ago is it since the rich copper vein of Lake Superior was discovered? Who discovered it? What is its magnitude?—D. S. N., Carlinville, Ill.

(2450) Car-Load of Grain.—How many pounds are estimated to be a car-load of grain? Is there any rule governing this?—F. K., Delafield, Wis.

(2451) Thickening Mineral Oil.—Please inform me of some cheap article that will thicken mineral oil, for lubricating, without discoloring or making it gummy.—E. M., San Francisco, Cal.

REPLIES.

(2429) Electricity as a Motive Power.—The motive power used for the plowing you refer to is not electricity, but steam; the electricity is only used to transmit the power of a stationary steam engine to those points of the field where the traction of the plow is to be applied, for which purpose flexible and movable conducting wires are far more available than rigid, fixed steam tubes or belts. The operation consists of the use of two or three dynamo-electric machines, such as we described on page 145 of our July number. One of them is placed in the building containing the steam engine, revolved by the same, and the electric current generated is conducted by isolated copper wires to the field where the plowing is to be performed, the wires are there connected with the other machines placed in the field; the electric current has here an inverse action—it makes these machines revolve, and this with a power which, if compared with that of the steam engine from which it originally is derived, shows no more loss than is incidental to any other method of transmission, and certainly less than would be the case if the transmission had to be effected to such distances, and under such continually variable circumstances, as the positions of the other machines in the field have continually to be shifted; one is placed at each side of the line in which the plow is to be moved, and they are started alternately to pull the plow in both directions in which it crosses and re-crosses the field. These machines, of course, work by wire ropes wound on revolving drums, and are placed on wheels and gradually moved forward while furrow after furrow is being made. As hand-labor is somewhat scarce throughout all France, and water power plentiful in many localities, it is expected that this method of transmitting the latter has a great future before it. It has already been successfully introduced in beet-root sugar manufactories for hauling and unloading material, and has been found to be far better for plowing than the steam plow, which can by no means be considered a success, but rather the contrary, and this for various reasons—their great first cost, weight, difficulty in moving, managing in the field, their necessary water supply, etc.; while the dynamo-electric machine, having no boiler, requires no water, costs far less than a portable engine for a steam plow, and does not weigh one-tenth as much as a steam engine of the same power. There is no doubt but that this new method of transmitting power has a great future before it, especially in those sections in this country where circumstances favor its application.

(2430) Anti-Moth Wrapping Paper.—The paper you refer to is probably that patented last year by a Mr. Rodgers, of Philadelphia. He dips strong paper into a mixture of 70 parts of the remnant of the distillation of coal tar naptha, or so-called dead oil, with 5 parts of crude carbolic acid, 20 parts of thin coal tar, and 5 parts of refined petroleum. The patent describes how much phenol the carbolic acid must contain, the temperature to which the thin coal tar must be heated before mixing, the hot rollers through which the paper is to be passed after the dipping, etc., all of which is quite unnecessary, except to make an attractive article for the trade. Any one can make an equally effective paper by dipping ordinary strong wrapping paper (by preference that made of jute or manila) into any of the carbolic acid preparations now in the market as disinfectants, and drying them. We could name the preparations especially adapted for this purpose, but refrain, as we do not want to be suspected of writing this to advertise some special manufacturer.

(2431) Imitating Mahogany and Walnut.—You will find in answers to Queries 1845 and 1940, in our June and October numbers for 1877, pages 144 and 240, full prescriptions for all kinds of stains for wood. We add that, for imitating mahogany you must use most all burnt sienna, with a little Vandyke brown. For black walnut take most all Vandyke brown. The answer to Query 1940, above referred to, will give you more details.

(2432) Horse-Power Needed on Inclines.—On an incline so extremely steep as to rise 7 inches to the foot, and thus more than 45 degrees, the cog wheel of 12 inches diameter, thus 3 feet in circumference, would have to make 20 revolutions per minute to attain a speed of 60 feet. But with this we have nothing to do in our calculation, only it should be attached to the engine with the intervention of gearing, as a locomotive only works to advantage when it makes some 200 revolutions per minute, thus 10 revolutions to 1 of the cog wheel. This is the plan on which the locomotives of the Mount Washington railway are constructed; but the incline there is by no means as steep as you propose, as with so steep an incline the central cog rail would be impracticable, for the reason that the cogs of the wheel would slip out of the rail cogs from want of pressure on the rail, the locomotive would almost stand on end, and a special arrangement made to attach it in such a manner to the wheel frame as to have furnace and boiler horizontal, while the pull of the cars behind would also tend to tip it over backward. We have seen such steep inclines in mines only, and in every case the cars are pulled up by a wire rope worked by a stationary engine. The actual pull required to raise a load on such an incline, is simply found by the Rule of Three: $12 : 7 = 35{,}000 : x$, and $x = 20{,}400$ pounds nearly. Reducing this to horse-power, which is $= 33{,}000$ foot-pounds per minute, we use again the Rule of Three: $20{,}400 : 33{,}000 = 1 : x$ and $x = 1.6$ foot very nearly. We see then that it takes 1 horse-power for every 20,400 pounds to make it travel 1.6 foot per minute on such an incline. But as you wish to travel 60 feet a minute, we say $1.6 : 60 = 1 : x$ and $x = 38$ horse-power; this is for pulling 20,400 pounds, and we find finally the pull required for 35,000 pounds thus: $20{,}400 : 35{,}000 = 38 : x$ and $x = 65.2$ horse-power. This is exclusive of friction, which, in lifting on such a steep incline, is no more than on a level grade, the friction of the pulling drum for the wire rope being compensated for by the lesser pressure and friction on the rails and axles.

(2433) Record of Letters Sent.—The best method we know of, and which has been adopted in the office of the Manufacturer and Builder, is to have at the beginning or end of the ordinary copying-book a number of ruled pages reserved for an index, arranged with the names of the parties addressed in alphabetical order. Two or four pages for each letter of the alphabet are sufficient. At the close or beginning of the day, each letter is indexed in its proper place, with the number of the page on which it may be found. You can also add date and subject, but we consider this entirely unnecessary, as for these you have only to turn to the page containing the letter, and then you know all about it.

(2434) Straightening Crooked Noses.—We do not know anything about the London nasal artist, but knew one who was established for many years at the corner of the Bowery and Hester street, in this city, and practiced the surgery of noses, also making a specialty (expressed on a large sign over the house, mentioning hours, etc.) as a "manufacturer of noses for the human face." The sign, however, has now disappeared, and we do not know what has become of the nasal artist. In regard to the instrument to correct crooked noses, it is evident that the same instrument could not possibly be of use for different noses—each nose would require the instrument to correspond, not only in size, but especially to be shaped according to the nature of the nasal curve. For instance, a turn-up nose, pointing to the sky, would require quite a different instrument from that necessary to correct a nose turned down so as to touch the chin, or a nose deformed by being smashed flat against the face would require an apparatus different from one intended to correct a nose flattened as if it had been squeezed between the jaws of a vice. The thing required would be a special apparatus for each malformation, the form of the apparatus to be decided by the nose doctor. If he understands surgery, and is intelligent, such a man may make great improvements in any kind of misshapen noses.

(2435) The Longest Tunnel.—There is a much longer tunnel now in the mines of Saxony. It is 32 miles in length, and we believe that this surpasses any tunnel in the world thus far constructed. The history of its construction may be sufficiently interesting to give here. At the close of 1835, the galleries had attained a length of 102 miles, and the works, commenced at the end of the twelfth century, had reached such a depth that any further descent was considered to be impracticable. In consequence a new gallery was opened, leading from the village of Rotschœnberg to a distance of 9 miles. The work was completed a year ago, and its execution occupied 33 years, necessitating an expenditure of over $2,000,000. This gallery, which had become longer than was originally intended, rises, generally speaking, at a gradient of 3 feet in 1,000, and, including the secondary galleries, the shaft of Rotschœnberg has now an extent of tunnelling of 25 miles, which will soon reach 36 miles. This far surpasses in length any tunnel in the world, so far as our information extends.

(2436) Patents on Feed-Water Heaters.—There are several patents on such arrangements. We saw one lately in Williamsburgh, N. Y., which was not exactly a coil, but a series of straight pieces of pipe, equivalent to a coil, and placed under the boiler. It was patented, and said to be very satisfactory. We wish to take this opportunity to correct an erroneous and very prevalent notion that such arrangements are a clear gain. The fact is overlooked that if you place pipes containing water in the fire, you reduce the temperature of the flame, and this may be done to such an extent as to change the boiler itself into a reservoir of steam, or steam drum partially filled with water. If the pipes are not placed in such a way as to secure active circulation, they will soon be burned out. The best way is to incline them and connect the lower and upper ends with the boiler above, to have plenty of them to rely upon for the generation of steam, and use the boiler as a steam drum. If you do this, you will perhaps have the best boiler in

existence, and it will be identical with the Babcock & Wilcox water tube steam boiler, which you may find at 30 Cortlandt street, this city, and in active operation in many manufacturing establishments. One of the best feed-water heaters in the market is the Berryman, manufactured by I. B. Davis, of Hartford, Conn.

(2437) Jet Pump.—The jet pump you refer to is probably the one patented July 16, 1878, and is nothing but a modification of the injector, originally invented by Giffard, and named after him. It was at first solely intended to supply steam boilers with water by means of a jet of their own steam. We believe that the original patent for this injector or jet pump has run out; but this is not the case with some improvements more recently patented.

(2438) Power Transmitted by Belts.—For an explanation in regard to the amount of power a given belt can transmit, we refer our correspondent to page 8 of our January number for 1877. The fundamental rule given there is this: *To find the required width of the belt in inches, multiply the horse-power by* 400 *and divide by the speed of the belt in feet per minute.* Consequently, to find the horse-power a given belt can transmit, we may from the above deduce an appropriate rule by treating the rule as an algebraic expression, and say:

$$W = \frac{400\ h}{S}$$

in which W is the width of the belt, h the horse-power, and S the speed of the belt in feet per minute. From this formula we easily deduce

$$h = \frac{W \times S}{400}$$

That is, in words, *multiply the width of the belt in inches with its speed in feet per minute, and divide the product by* 400. *The quotient will be the horse-power the belt can transmit.* Our correspondent will see that in his statement he has omitted the necessary element of the velocity of the belt, which we will now calculate for him. We will find what the velocity of his 4½-inch belt must be, so as to transmit the 6 horse-power he asks about. Our formula can be changed to this shape:

$$S = \frac{400\ h}{W}$$

which, transposed into words, means: *To find the belt velocity required, multiply the horse-power with* 400, *and divide by the width of the belt.* Apply this to your case; the horse-power 6 multiplied by 400 gives 2,400, this divided by 4½ gives 533 feet, so that your belt must move with a velocity of 533 feet per minute, and then will transmit the 6 horse-power required, which is at the moderate speed of only 6 miles per hour. Mark well that it may move faster, but if moved slower it cannot transmit the 6 horse-power. This will also teach you that by doubling the diameter of the driving pulley you may double the power the belt can transmit, and *vice versa.* In regard to damages, it is almost self-evident that if your belt slips, it is your own fault. Your belt is either too narrow or moves too slowly, and the vender of the horse-power has nothing to do with it. If, however, your belt does not slip, but the work you do stops the driving steam engine, it is the fault of the engine, and the vender of the power is responsible if you can prove that you do not use more than 6 horse-power. This can be easily settled, either by the use of a dynamometer or by means of indicator diagrams taken on the steam engine when your belt is detached, and then while the belt is attached and you are doing your work requiring the power specified. The comparison of such diagrams will show whether you get the power agreed upon or whether you under-estimate the power you need.

(2439) Will the Panama Canal Pay?—The Panama canal will certainly pay large profits to those who invest their money in it. The only question has been the possibility of its construction; but the confidence of the eminent engineer, M. De Lesseps, based on his large experience, his success with the Suez canal, and the immense resources of modern engineering, leave no doubt of the feasibility of the enterprise. Before the existence of the similar canal—that of Suez—there might have been some reasonable doubt as to its paying profits, but the experience with that canal settles this matter, the dividends now being large and constantly increasing. The income at present is $7,500,000 a year; expenses, $1,000,000; sinking fund, $2,500,000; balance, $4,000,000 for interest on bonds. It was especially in England that the investment was looked upon with distrust, and the effect of the adverse criticisms of the English papers was such, that when work on the canal had commenced the $100 shares fell to $20. When the canal was ready they rose to $60; but the English, who now profit by it more than any other nation, did not yet see it, and would not buy, believing that ships could not successfully pass through a canal made by the French. When, however, its success was proved by experience, the canal stock soon rose to par, and even above. Then the English opened their eyes, and wanted their government to buy stock, so as to have control in the matter, and five years after the canal was in operation the English government invested $20,000,000, buying 176,000 shares at $114. Their present market value is $144, and over. The whole canal has cost over $92,000,000, and as the total number of shares is about 1,000,000, the English government controls about one-sixth. The same history no doubt will be repeated in connection with the Panama canal, except that the lesson of the Suez canal will teach more timely confidence, with less depreciation of the stock at the beginning.

(2440) Reckoning Dates in Remote Parts of the World.—Asia reckons with the regions west of it—Europe and America; the whole of Asia, including Japan, also Australia and the surrounding islands; but the greater part of the Pacific ocean, however, reckons with the regions east of it—that is, the American continent. For further elucidation we refer to an article and map on page 179 of this number.

(2441) Chemicals for Hydro-Oxygen Light.—The chemicals are chlorate of potash and binoxid of manganese to make oxygen; zinc, sulphuric acid, and water to make hydrogen. They are used as follows: The chlorate of potash, mixed with one-quarter its bulk of manganese, is placed in an iron retort, of which it must fill one-third or one-half, then heated, and the gas generated passed through a washing bottle to cool and purify; it is then collected into a rubber bag, gasometer, or large bell jar, when it is ready for use. The zinc is granulated or cut up and placed in water, to which one-tenth of its weight of sulphuric acid is gradually added; the gas developed is collected into another bag, gasometer, or bell jar. Then you are ready for operation; the hydrogen is blown by a jet on a piece of solid quicklime and ignited, then the oxygen is turned on so to blow on the same spot; this will increase the heat of the combustion to such an extent as to make the quicklime hotter and more luminous than can be done by any ordinary fire, and this produces the intense light. There are several arrangements of the jets; one is to have separate jets for the hydrogen and the oxygen; another to have one jet, of which the central hole blows oxygen, and the annular hole around it blows hydrogen. Another arrangement again mixes the gases in the tube, so that they blow out as a mixture through one single opening; this gives the best light, but is somewhat hazardous, as the gases may become mixed in the reservoirs from an unequal pressure, and a regurgitation by some impediment in the jet, when an explosion is sure to follow. Scores of instances are on record of such explosions, which are very powerful, and have often done a great deal of damage. An important feature in the use of this light is to place it in the right spot in the magic lantern; it may be ever so good, but if not carefully focussed it fails to produce satisfactory results. Good judgment, guided by the experience obtained from repeated trials, is the only way to obtain success.

(2442) Sawyers' Technical Terms.—A "round" and "live" gang mean the same. In the Eastern States they call a "round gang" what in the West they call a "live gang." The terms mean such an arrangement of the saw mill as causes the whole log to be cut up into boards at one operation, while a "slabbing gang" is one by which from only the two sides of a log slabs are cut off, while the middle part remains as a thick beam. When the log is carried forward on a carriage termed a "saddle," it is called a "saddle slabber." After a beam has been flattened by passing through the "slabber gang," it can be sawn into boards of equal width in the "flat gang," when it will of course be straighter than if sawed only on a "round" or "live" gang. A "pony" is a single or small flat gang, used for sawing thin boards out of the best quality of timber.

(2443) Japanese Spheres of Rock Crystal.—The difference between glass and pebble is that pebble is a better conductor of heat than glass, and therefore feels, like all other gems, colder to the tongue than their glass imitations. This is test No. 1; test No. 2 is to look for air bubbles; if with a magnifying glass you discover the minutest air bubble, it is certainly glass, as in natural stones air bubbles are never found. Test No. 3 is the hardness; a piece of a steel file will scratch glass, but it will not scratch pebble or other precious stones. Test No. 4 is polarized light; a piece of glass placed between the polarizer and analyzer of a polariscope does not show anything peculiar, while any part of a crystallized substance will show either variable colors or at least changes of light and darkness when its position is changed, the dark spots showing the direction of the axis of crystallization. All the globes we have seen, and which were sold as Japanese pebbles, satisfied all these tests, and therefore are genuine. Glass imitations we have not yet seen, except coarse glass balls, which are easily recognized at first sight. In regard to the manner of making them, we extract from *Harper's Monthly* for August the following: "A man has been out on the hills digging out the crude quartz; having secured a basketful, he passes them over to the 'splitter,' whose part of the work is to break off the long bars of rock into bits the gross size of the ball or bead to be made therefrom. Laying the long piece on a large stone covered with a piece of matting, with the end of calculated length to be broken off protruding over the edge of the stone, a sharp quick blow with the steel-edged hammer usually severs it. On larger and thicker pieces a gutter is first nicked out around the surface sufficiently deep before the final blow is struck. Skill and a 'knack' are of great account in this process. The truncated prisms are then handed over to the man who rounds them off into rough globes, which is done by careful chipping with a tiny steel-edged hammer. It is astonishing how, with simple skill, the man will make a tolerably perfect sphere with a very ordinary tool; he soons learns the mysteries of the planes of cleavage, where to tap lightly, where heavily, when to chip, and when to pound. The rough-coated balls are now passed to the grinder, who has ready a tub of water and four or five partly cylindrical pieces of cast-iron, a little over a foot long, and looking like reversed graters. These are of different sizes and curves, according to the size of the ball to be ground. The grinding material consists of powdered garnet of various degrees of coarseness. The grinder uses water plentifully, and dexterously keeps the balls turning so as to make the surface spherically equal. In some cases the ball is fixed into the end of a bamboo tube, and the grinding finished by whirling it between the palms of the hands in a half spherical iron or stone socket. The globe is now smooth, but the perfect polish has yet to be done by patient rubbing with the tip of a bamboo cane, and then in the hands with cloths dipped in crocus, rouge, or native oxid of iron. This produces a splendid lustrous surface, and the gem is water-clear, and as refractive to the morning light as a drop of dew that nestles in the heart of the lotus."

(2444) Paint for Rusty Iron.—Black Japan varnish, mixed with turpentine, to make it thinner if necessary, is one of the best preventatives; but the iron must be dry when you put it on. If you can warm the iron when painting it, so much the better. If not sufficiently opaque, you may put in dry finely pulverized paint, such as lampblack. Red lead, with linseed oil, is also a good paint for iron; so are the mineral reddish-browns which consist of oxid of iron; they become very hard, and are used for the iron-work of the elevated railroads in this city.

(2445) Steaming Wood.—This depends on the kind of wood, size of pieces, and the subsequent operation; for instance, to steam ash and hickory for curved plow handles, requires higher heat than softer woods. Pressure is only necessary in case of very large pieces; usually the steam is admitted into the steam box with scarcely any pressure, only keeping the wood sufficiently hot for say from 10 to 40 minutes. The only way to settle this to your own satisfaction is to try it on the pieces you wish to treat. This is the way various manufacturers found out what they wanted to know, and it is the only way such things can be found out.

(2446) Teacher of Penmanship.—One of the best instructors in this branch is Daniel T. Ames, of 205 Broadway, New York, to whom we refer you.

(2447) Cure for Pimples.—We answered this in reply to Query 1002, on page 144 of our June number for 1874. Sulphur is said to have occasionally done some good, but we have most always found it useless. Therefore, as is often the case with a remedy, the cure may have been the result of another cause, and the remedy which was being applied at the time got the credit of it.

(2448) Ohm, Volt, and Weber.—The Ohm is the unit for the measure of resistance, the Volt for the electro-motive force or energy, and the Weber the unit for the measure of the current or quality. The Ohm is named after Ohm, who laid down the laws; it is the resistance offered to a current by a copper wire of ¼ inch diameter and 6046.5 long, or, according to the metric system, the resistance offered by a column of mercury 1 millimeter in diameter and 1 meter long, which is nearly the same as the other statement, as may be easily verified by remembering that copper conducts 60 times better than mercury, and the resistance increases in the ratio of the length, and inversely in the ratio of the square of the diameter. The Volt, named after Volta, is a unit nearly equal to the electro-motive force or energy of a Daniel cell. It should be understood that the intensity of such a cell is independent of the size, an increased size only increases the quantity, while the intensity is only increased by coupling the cells, and then it will be proportional to the number of cells. A Weber, or Veber, as the French call it, (the French alphabet having no W), represents the energy set free by the combustion of 11 grains of carbon or coal, or 1 grain of hydrogen, with a development of 6 units of heat in 6,338 seconds. Then if 1 Volt of electro-motive force compels 1 Weber of electric current to pass through a wire of 1 Ohm resistance, it will develop 6 units of heat in the current in 6,338 seconds. This is equivalent to 4,673 foot-pounds of energy as the heat developed is the measure of the force.

(2449) The Lake Superior Copper Mines.—This discovery was made about fourteen years ago, and the actual discoverer was a pig, who, while digging the ground in the woods with his snout, after the fashion of pigs, unearthed a piece of native copper. The pig was the property of a miner who lived in a wood that had been bought by the St. Mary's Canal Company for the lumber upon it. A search revealed the existence of a rich, gigantic vein. Two companies were organized, which soon afterward consolidated. Shafts opened at different places produced for several years more than 1,300 tons of pure copper. There are now 8 shafts leading to a vein of ¾ of a mile; there is still a mile of it left, which is as yet untouched. It was known long ago that the Mound Builders (a race of Indians supposed to be entirely different from the present Indian savages) possessed copper derived from the Lake Superior mines; but the rich vein now being worked was then unknown. It is the richest vein known in the world, so rich, indeed, that if it were worked to its full capacity, it would overstock the market and reduce the price of copper below its real value, and the owners of the mine wisely do not do this.

(2450) Car-Load of Grain.—The uncertainty of this has recently been settled by the Milwaukee Chamber of Commerce, which decided that the weight must vary, according to the bulk of the different kinds of grain. For wheat, 20,000 pounds has been adopted; for corn or rye, 18,000 pounds; and for oats and barley, 16,000 pounds, these quantities producing about the same convenient bulk for the ordinary cars in which grain is commonly transported there.

(2451) Thickening Mineral Oil.—Paraffin, either pure white or crude yellow, will accomplish what you desire. Melt it over a slow fire and pour in the warmed oil slowly. One pound of paraffin will thicken a gallon of oil. If not thick enough for your purpose, you may of course put in as much as you like.

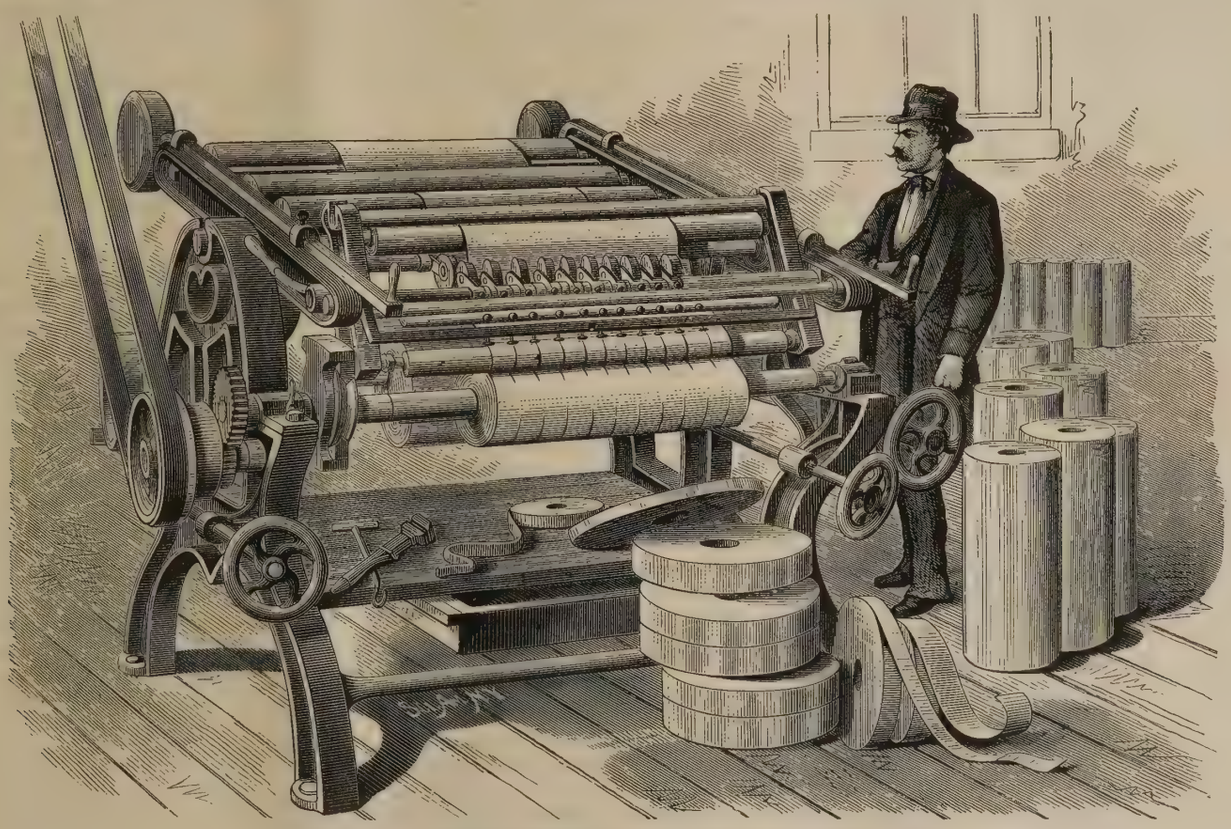
THE MANUFACTURER AND BUILDER.

Vol. XI.—No. 9. SEPTEMBER, 1879. ELEVENTH YEAR.

Paper Cutting and Winding Machine.

The vast quantity of roll paper used in telegraphy, for rolling ribbons, hat bindings, and divers other purposes, has rendered the invention of some method by which the cutting and rolling might be done rapidly and cheaply a great desideratum. Several efforts in this direction had been attempted with more or less success, when Mr. Ignatz Frank, of this city, invented the ingenious machine represented in our illustration.

It would seem difficult to construct a machine performing the work that this does, without complication, yet the inventor has succeeded in securing a great degree of simplicity, and at the same time perfect and uniform adjustment. The machine is infallible in its operation, and that it will supplant other machines intended for the same purposes, there would seem, from its wonderful performance, to be little question.



FRANK'S PAPER CUTTING AND WINDING MACHINE.

Referring to the figure, the roll of paper to be cut into strips is placed on a shaft at the rear of the machine, and is passed alternately over and under the rolls in the pivoted frame at the top of the machine, thence between circular shears to the shaft that receives the strips. This shaft is rotated by power received through the belt, and the circular shears are turned by the paper itself, which passes between elastic rollers on the shear shaft. Tension is given the paper by a friction brake on the shaft holding the paper supply. The rollers in the pivoted frame smooth and stretch the paper, and the shears make a clean cut without danger of tearing the fibre. The machine will cut paper strips of any desired width and wind them in solid coils, while it can be adapted to paper of any thickness, from the finest tissue to cardboard.

Only one attendant is required, and the expenditure of less than one horse-power will cut into strips of any desired width from 2,000 to 6,000 pounds of paper in ten hours, and wind it perfectly. The machine might be easily combined with a paper machine so as to cut and wind the paper as it comes from the calender without the necessity of re-winding—in fact, it seems a very important adjunct to paper machines designed to manufacture paper in rolls.

This machine is manufactured by the Cutting and Winding Machine Company, whose office is at 321 Pearl street, New York; J. Cohen, President; George W. Gilbert, Secretary. The factory of the company, managed by Mr. George L. Carlton, is at 124 Baxter street, where the machine can be seen at work. They both make and sell the machines, and do the work for those who may require paper cutting.

Fall Exhibitions.

The present autumn promises to very rich in industrial displays at the various exhibitions that are to be held during the season, and a fresh enthusiasm seems to have taken hold of the managers in our cities and incited them to extraordinary effort to surpass the exhibitions of former years. This is, no doubt, the result of the improved condition of business in all industrial centers, and the consequent desire on the part of the manufacturer and inventor to meet the consumer with the products of their skill.

Exhibitions are to be held in this city, at Chicago, St. Louis, Cincinnati, Louisville, San Francisco, and Pittsburgh.

The American Institute Exhibition opens in New York city September 17th, and will close in November. Unusual facilities are offered this year to exhibitors intending to operate machinery, or illustrate any process of manufacture.

The Inter-State Industrial Exposition of Chicago opened September 3d, and will close October 18th. The previous fairs have attracted an average attendance of not less than 400,000 persons each year since the commencement. The fairs have steadily improved, and this year there is a very grand display of industrial products from all sections of the country and the attendance of visitors thus far has been large. The classification embraces ten departments.

The St. Louis fair and exposition of the St. Louis Agricultural and Mechanical Association opens September 22d, and closes October 11th. There are to be fourteen classes of exhibits, and a full line of attractions is offered.

The Seventh Annual Louisville Industrial Exposition opened September 2d, and will close October 18th. This exhibition surpasses that of any previous year.

The Seventh Cincinnati Industrial Exposition opens September 10th, and closes October 11th, and is expected to surpass in variety and magnitude all other expositions held in this country, except the Centennial

in Philadelphia. The exhibits are to be divided into 16 departments, having in all over 60,000 feet of exhibiting space and 600 feet of line shafting.

The Fair of the San Francisco Mechanics Institute opened August 5th, with an unusually fine exhibition.

The exhibition of the Pittsburgh Exposition Society opened September 4th, and will close October 11th.

The Manufacturer and Builder.

A MONTHLY JOURNAL

DEVOTED TO THE

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This journal has the largest circulation of any mechanical monthly published in the United States. Its value as an advertising medium is therefore apparent.

Vol. XI. No. 9 ELEVENTH YEAR.

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Agencies where the Manufacturer and Builder can be Found on Sale.

The following News Companies in the principal cities of the United States and Canada are agents for the sale of the MANUFACTURER AND BUILDER, and are prepared to supply the same promptly:

American News Company, New York.
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San Francisco News Co., San Francisco, Cal.
Brooklyn News Co., Brooklyn, L. I.
Newark News Co., Newark, N. J.
Northern News Co., Troy, N. Y.
Albany News Co., Albany, N. Y.
Toronto News Co., Toronto, Ontario, Canada.
Toronto News Co., Clifton, Ontario, Canada.

Special Edition for Australia.

We desire to make announcement of the fact that we intend sending 5,000 copies of our October number to Australia, for distribution at the World's Fair now being held at Sydney, and to this end we have made arrangements with a special agent there to represent us, and under whose supervision the distribution will be made. Advertisers will appreciate the value of this edition for reaching the great Australian trade, and we trust that we will by their aid be enabled to make the October number a representative one, presenting our Australian friends, by letter-press and illustration, the fruits of American inventive skill and ingenuity.

Our Incipient Prosperity.

It appears that at this time, among the civilized countries of the world, there are but two which can be called really prosperous; they are the United States and our old ally, France, which so nobly assisted us to gain our independence from monarchical despotism. We can only rejoice that that beautiful country has at last successfully freed herself from the same curse, and we hope that the efforts of those who hate republican institutions will be defeated by wise legislation. It appears, indeed, that such men would rather enslave their native land under the iron rule of some bigoted or military despot, such as a Bourbon or a Bonaparte, than see a successful government by the people. Fortunately, we are free from such dangers, as there are no claimants to thrones on this side of the ocean; all we have to fear is unwise legislation; but then the natural resources of this country are so great that we will prosper in spite of legislators. The experience of the present day proves this.

All that was needed to restore confidence and cause capital to flow into those legitimate channels—manufactures and commerce, which distribute money among those who are able and willing to earn it—was the stopping of all speculation in gold by the United States government accepting its own paper currency at par with gold. We have always held that it was a most fatal blunder in our legislation for the government to refuse its own greenback legal currency in payment for Custom House duties. It has been the cause of all gold speculation, the ruination of many speculators, the depreciation of the value of the legal tender, the mistrust of the naturally shy capitalist, the hoarding up of capital, and its consequent withdrawal from industrial enterprises, which thereby languished.

But let us thank heaven that those times are past, and that the government, by correcting this mistake, has so much regained public confidence, that, for instance, during the two weeks ending August 9th, the city of New York alone paid into the sub-Treasury some $60,000,000 in greenbacks, in payment for United States bonds bearing only 4 per cent interest. This was independent of many heavy payments on account of "called" bonds. That this immense withdrawal of legal tenders caused no monetary disturbance in this city, proves how much money there was left for the wants of ordinary circulation.

The prospect for the future is still more favorable. The success of our crops of breadstuffs, and their failure in many European countries, will create a demand for the 150,000,000 bushels of wheat that we will have to spare. Our cotton and woollen factories are doing a steady and satisfactory business, as are also our shoe and leather industries. The iron industry is rapidly and steadily improving, while railroad building is being resumed all over the country. The demand for improved dwellings is great, and consequently real estate is increasing in value and the building business flourishing. The exportation of materials, such as cotton and petroleum, has only to be mentioned to prove the influx of gold it must produce as a necessary consequence.

A current of gold has already set out from Europe to this country, and it can only continue to increase as the balance of trade must be more and more in our favor, and our country is on the eve of a greater prosperity than ever before, far surpassing the conceptions of our ancestors.

Advancing or Diffusing Science, which?

The *Scientific American*, in mentioning the yearly meeting of the American Association for the Advancement of Science, at Saratoga, N. Y., August 27th, takes the opportunity to criticise that association, first, by the remark that some papers printed in the annual volume "would have better found their medium of publication in the proceedings of local scientific bodies, or in special series devoted to their subjects." This being a mere matter of private opinion, we will not discuss it here; but another criticism is more serious. The paper referred to says: "The general aims of the association would be greatly furthered if a plan of evening lectures could be entered upon at which the public could freely attend during each session." To this we answer that the public can and does freely attend all the meetings of the society, as well during the day as the evening lectures. The paper continues thus: "The popularization of knowledge would in this way be assisted, and the association benefitted, both in reputation and in membership, by identifying itself more boldly than it has yet done with the cause of popular instruction."

The *Scientific American* says further: "The sooner this association commits itself as a matter of principle to the furtherance of science among the people, the more following it will have and the greater influence. And if it does not, it will fall behind its peculiar duty and out of the line of advance in human thought. . . . This association should no longer delay to bring all its forces to bear upon the question of science as applied to education. While it does not do so, it will always seem to shirk a duty and ignore the chief end of its existence."

We quote thus largely in order to bring into strong relief the misapprehension under which many labor in regard to this association. They forget that the very name of the association, which indicates the "chief end of its existence"—the American Association for the Advancement of Science—is quite a different thing from the *diffusion of science*, or "science as applied to education." We hold that this society was not at all founded for such a purpose—that its aims have never been to popularize science, but to increase the stock of scientific knowledge, leaving it to other institutions to take care of its diffusion, and its application to educational purposes. It is the same with the Smithsonian Institution in Washington, in regard to which Prof. Henry has often remarked to us, that the public continually misunderstood its object, and wished to have its funds applied for popular instruction, while he rightly held that the terms of the bequest were that its sole purpose should be the *advancement of science*, which was accomplished by making collections, experiments, observations, and the publication of newly discovered facts in science. If the general public is benefitted by seeing the Smithsonian collection and reading its publications, as far as they can be understood by the unscientific novice, it is an incidental advantage, not included in the purpose of the institution. In the same way, if the general public can find satisfaction in attending the meetings of the American Association for the Advancement of Science, and be benefitted by what they can understand, it is also an incidental advantage, not included in the purpose for which the association was formed.

It should be understood that the association was formed by scientific investigators, most of whom are professors of schools, colleges, or universities, who devote nearly their whole time to teaching, while there

are a number who possess sufficient knowledge to labor in untrodden fields of scientific research and make valuable discoveries and inventions. In order to bring the latter before the world, so that science, and consequently all mankind, may have the benefit of the increased knowledge, they formed an association in which each who has discovered anything interesting, has an opportunity to bring it before a meeting of men who are his peers, and who can judge of and discuss its merits. The most valuable contributions of this kind are published in an annual volume, which is a record of what the members of the association have contributed to the progress of science during the preceding year.

This, and nothing more, is "the chief end of its existence," and if the association has appointed a committee upon weights, measures and coinage, upon meteorological researches, upon the introduction of science into public schools, etc., it has already done much more than was intended in the original plan. To require that this association should take the lead in popular scientific instruction, shows ignorance of the requirements of such a task.

Indeed, what can an association, which meets once a year for a few days only, and this on each occasion in a different city, do in such a field? Most of its members, as remarked above, devote their whole life to instruction, each in the circle where he is located, and in this way works individually for the very thing which it is claimed the association as a whole should do. An association intended for such a task, must be formed on a very different basis, and we advise those who assert so loudly that the American Association for the Advancement of Science does "ignore the chief end of its existence," to found another society under the title of the "American Society for the Diffusion of Science." But this should be organized on an entirely different plan. For the benefit of those who may possibly take this matter into serious consideration we will give here the plan on which the Society for the Public Good is founded in the Netherlands. The headquarters is in Amsterdam; in nearly every city there is a branch, the members of which select their own local officers. Each member of these branch societies contribute about $2 a year, of which half goes to headquarters, forming a fund from which schools are maintained in various cities; in these schools scientific and technological education are the prominent features. Then these local branches have regular meetings, where lectures are given on interesting scientific or literary topics. Besides the support of the schools, the society at its headquarters enters largely into the publication business. The books are mostly text-books for schools, or treatise on subjects useful for the people, called for by the wants of the times.

The manner in which the Netherlands Society for the Public Good obtains the matter for publication is by prize medals. As an illustration, we give one of the items of the programme for 1842: "As the text-book on natural philosophy, by A. M. Buys, published by this society in 1816, has become antiquated by the progress of physical science since that time, the society offers the large gold medal for the matter of a new text-book on natural philosophy, worked up to the present standpoint. It is proposed to leave out the part belonging to natural history, as the society has already published a separate text-book on that subject. The manuscript must be written by another hand than that of the author, and be accompanied by a sealed envelope containing his signature, which will be returned unopened with the manuscript in case the work is not accepted. Manuscripts to be sent in before January 1, 1844."

We will only add that the editor of this journal obtained the gold medal for such a text-book on Physics in 1845.

Religious and political subjects are excluded, as well in the publications of this society as in their schools; this rule is applied so strictly that the reading of the Bible, praying in the schools, or religious exercises of any kind are forbidden. This, by the way, is also the case in all the public schools in the Netherlands, as well as in all the colleges and universities. Religious exercises are unknown in any of them, except of course in the theological seminaries, where they make up for the rest, each after its own fashion.

Illustrations as Advertisements.

There is no doubt that to attract the attention of men of all countries who are looking around for something to buy, there is nothing that so favorably impresses the mind as pictorial representations of the objects, whether it be machinery, furniture, houses, or any other product of industry. This is especially true of a journal with a foreign circulation like the MANUFACTURER AND BUILDER, which has often furnished to its advertising patrons orders from most all the countries of Europe, from Mexico, the West Indies and South America, from the East Indies, Australia, and even China and Japan.

One of our English contemporaries, which makes advertising for foreign trade a specialty, publishes a letter received from the Cape of Good Hope, which illustrates this fact very forcibly, and deserves the earnest attention of our manufacturers. We quote a portion of it:

"The pictorial part of your journal—the descriptions of specialties, new inventions and improvements, in such departments as the house, the farm, the field, and the fold, to which may be added the ordinary workshops, such as coach-makers', wheelwrights', etc., are all subjects of importance to the various interests here. Common, every-day things are preferred to the higher class put forth by men of science. You have a multitude of common things in Europe [and in America also, say we] to make trade with here and in the colonies, and which would be welcomed here if only seen. Your journal might be used for introducing them. Sample cases should also be forwarded. We have heard that American calico is taking the place of the old (English) brands. The quality and the price is the sole alleged cause. American and German specialties are getting and taking a leading place among us. We may add that goods might command a large sale in this colony were they more accessible. Our advice would be—send samples and pictorial drawings."

Our columns bear evidence to the fact that we have no reason to complain of the liberality with which our patrons have availed themselves of the medium of this journal to reach the markets of the world and to enable them to give illustrations of the productions of their industries. These will evidently be especially appreciated by those foreigners who are so imperfectly acquainted with the English language as to be most benefitted by the pictorial part of an article. But even those who understand our language are exceedingly benefitted by having the description accompanied by an illustration. In regard to the descriptions we give, our patrons may be assured that our statements are correct, while we on our part feel that we can do better justice to any piece of machinery when our description is illustrated with a good engraving.

Therefore we advise all interested not to be backward in this line; we live in a time of illustrating even the events of the day. While twenty-five years ago illustrated weeklies were started and failed, we have now a large number of them in New York city, and even an illustrated daily. If common daily events are worth illustrating, are not the machines, the products of genius, applied during untold days and years of labor and care, worth being brought before the public by the pencil of the artist and the tool of the engraver?

Steam Heating as Applied to Cities.

The Spinola plan of heating the buildings of a whole town or city by steam, is severely attacked by "An Engineer" in a letter published in one of our dailies. He considers it an enormous stock jobbing scheme, alongside of which any possible elevated railroad grab sinks into utter insignificance and appears an innocent operation. His calculation is as follows:

"There are in this city, exclusive of Morrisania and West Farms, fully 1,600 built-up blocks, with about 90,000 houses, making 16 steam districts, and requiring 16 times 240,000,000 cubic feet of steam per day as the estimated supply. Not quite two-thirds of this steam will be virtually furnished to customers, as fully one-third is lost from condensation and leakage. But to afford a daily supply as averred, would necessitate the making of about 4,000,000,000 feet of steam every 24 hours, or nearly as much as the supply of illuminating gas now amounts to in a whole year. About 8,000,000 gallons of water would be required per day to be distributed among 1,000 boilers, each of a capacity for evaporating 18,000 gallons of water in 24 hours. The daily water supply would have to be increased one-fifth its present capacity, and in order not to place the city on 1,000 small volcanoes, by running that number of boilers all the time, (24 hours), the boiler service must be doubled—that is, 2,000 be set up, each one running 12 hours per day. It is unnecessary to say more in pointing out the monstrosity of the scheme, even admitting that former figures, on which the foregoing calculation is based, were exaggerated. But who will dare to say that cheap heat can be supplied by this steam scheme, and what on the whole the boon offered by this corporation will amount to? Can one bake, broil, roast, melt or smelt with the heat thus furnished? If the steam is furnished superheated, its cost will be enormous, and if supplied as ordinary steam it will afford 212° Fah., and no more. But it will never be furnished on an extensive scale, for the bubble will have to burst long before the last of the confiding fools who put their money in it has been reached by the operators."

The above estimate may have something startling in mentioning the 4,000,000,000 cubic feet of steam necessary per day, and comparing it with the gas furnished to a city of this size; but after a thoughtful consideration, it soon dwindles down and appears no more startling than the results of any gas work about which, before its general introduction, similar objections were urged.

In the first place, the water used will by no means be lost, because most all of the steam employed will be returned to the boilers, as is the case with all steam heating contrivances; it is simply a circulation of the water, which serves to convey the heat to the various buildings, which heat is given off during its condensation, while the hot water into which it is converted, returns to the boilers, which, for that purpose, are always placed at the lowest practicable level. Therefore, the objection that it would necessitate an increased water supply, falls to the ground.

Let us now look at the cost of the fuel required. As every pound of coal consumed can convert 14 pounds of water into steam, 8,000,000 gallons, or 64,000,000 pounds of water necessary, would require 4,500,000 pounds of coal, which, for 90,000 houses, is 50 pounds each per day, so that a ton of coal would furnish steam for 40 days, and 3 tons be sufficient for 120 days, or 4 months. We would like to know if there are many houses where 3 tons of coal are sufficient to do the heating and cooking during the four winter months.

The pretensions that the cost of superheated steam is enormous, and that ordinary steam will only afford 212° Fah., and no more, are equally false. Ordinary steam, as used for heating purposes, at a pressure of 60 pounds, has a temperature of some 280 or 300°, and this is sufficient for family use. The Spinola plan does not pretend to furnish heat for melting and smelting operations. The demand for such heat is very rare in cities, and can be easily supplied by gas or other fuel, also in cases where broiling and roasting are required.

If we test the amounts mentioned in the above calculations with our experience, they well agree, and do not appear exaggerated. In the five-story and basement building in which the MANUFACTURER AND BUILDER is published, 180 tons of coal are used on an average per winter. The building occupies a whole block, and

being rented out to about 60 various concerns, among which are some very large ones, such as the New York *World*, is equivalent to 30 ordinary houses; so that the 180 tons of coal is 6 tons for each house per year. The steam heating is applied for about 7 months.

The following paragraph is identical with the objection made fifty years ago against the introduction of gas:

"The laying of the pipes alone will kill the scheme, as it will prove wholly impracticable. But by all means let a test be made in one district to prove the utter impracticability of Spinola's bantling."

We answer, if steam is found economical for heating our public buildings, like the Cooper Institute, our large libraries, also almost every building in which large publishing concerns are located, in the principal hotels, the new buildings erected by insurance companies, those by various other companies, and by private capitalists who have recently invested in colossal sites, why then would the system cease to be economical when applied to a whole block? And if economical for a block, why not for a district?

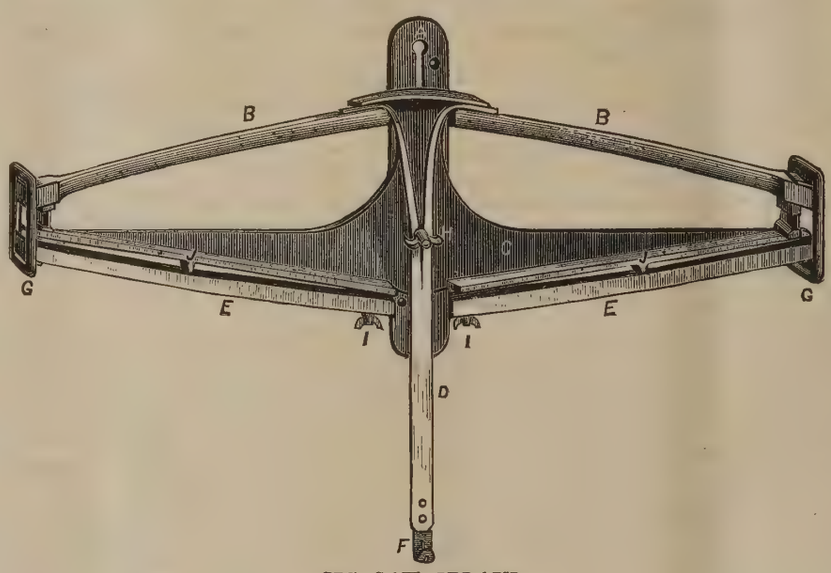
But the true inwardness of the criticism of "An Engineer" crops out in his closing paragraph. He says:

"What we need is cheap, clean, and convenient fuel for all purposes, in the shape of gas—fixed, unchangeable and non-explosive, and capable of producing any degree of heat from the boiling of water to the smelting of iron."

This shows that the whole article is an attack written in favor of gas companies.

Improved Spring for Scroll Saws.

One of the reasons why scroll saws are sometimes unexpectedly fractured is that the spring pulling them upward is not as quickly acting as it should be, caused by its having too much weight and momentum, which always retards all rapid to-and-fro motions. In the spring represented in the adjoined engraving this defect has been successfully obviated, and the result is a spring which cannot only be applied to jig saws, but to any machine requiring a very quickly acting spring, adjustable to various degrees of tension, and adapted to any size of saw blade. The maker claims that with its use an inferior machine can be made to work well, which is an important fact, as there are many inferior machines in use, which may all be improved by the substitution of this spring in place of the inferior one that renders many of these machines almost worthless, as it is impossible to run them at a great speed without danger of breaking the saw blades. It is claimed for this spring that a scroll saw can be run with it at the rate of 1,000 strokes per minute without the least risk. We therefore advise all who contemplate buying a new jig saw because they are not satisfied with what they have, to try this spring, and attach it to their machine.



JIG SAW STRAIN.

In our engraving, the top A is attached to the stand above the table by means of wood screws; this part is slotted for adjustment to the hight of the stroke, so as to allow for different lengths of saws. B B are wooden arms, supporting the strap D, to which the saw is attached by means of the hook F; the top of the strap D has two hooks lapping over the arms B B, which turn on pivots at their outer ends, and rest at G G upon wooden springs E E. The latter rest on fulcrums or bridges, affording a leverage which gives an easy motion to the springs. The movements of these springs are very slight, not over ¼ of an inch to the full stroke of the saw, showing that it is quite safe to run the machine at a very high speed. The strength and stiffness of these springs are regulated by the thumb screws I I, by which they can be easily adjusted to the tension required.

This spring is manufactured by I. R. Joslin, of 91 Liberty street, New York, to whom we are indebted for this illustration.

The Return of Business Prosperity.

That a revival in business has at last set in we find abundant evidence among our manufacturers, many of whom, by an unprecedented rush of orders, are running their works to their fullest capacity, and in some cases have orders in hand sufficient to keep them busy for months ahead. The demand for steam power for manufacturing purposes is shown by the statement of Messrs. Babcock & Wilcox, of 30 Cortland street, this city, to be something surprising, and is one of the most conclusive arguments that the wheels of industry have at last begun to turn. This firm report that they have now in hand orders for the following list of their celebrated water tube boilers: 150 horse-power for the Columbia College School of Mines; 400 horse-power for J. A. Bostwick's Brooklyn oil refinery; 90 horse-power for Lombard & Ayres' oil refinery, Bayonne, N. J., their second order; 125 horse-power for Cooper & Lawrence's new rope walk in Brooklyn; 200 horse-power for "Yngenio Union," Cuba; 75 horse-power for "Yngenio Angelina," San Domingo; 250 horse-power for Wm. Whitaker & Sons' woollen mill, Philadelphia; 200 horse-power for Fairmont Worsted Mill, Philadelphia; 500 horse-power for the new Erie elevator, Jersey City; 450 horse-power for Studebaker Bros. M'f'g Co., South Bend, Ind., (the fourth order from this firm); and 1,520 horse power, in four batteries, for Harrison, Havemeyer & Co.'s sugar refinery, Philadelphia, (also the fourth order from this firm since 1871.

In other lines we find the same encouraging reports. The S. A. Woods Machine Co., of 91 Liberty street, this city, state that business is better than it has been for 5 years past. The Baldwin locomotive works, of Philadelphia, took sixty-four orders for locomotives during August. The Blake M'f'g Co., of Boston and this city, are working full time, with three months' orders ahead.

One Boiler Bursts at Last.

At last an engineer has succeeded in bursting one boiler out of the many thousands insured by the Hartford Steam Boiler Inspection and Insurance Company The simple reason was of course, as it always is, that he got up more steam pressure than the boiler could stand. If the boiler had possessed a very weak spot, this would have given way, allowing the escape of the superfluous pressure, and the damage would not have been so great; but, unfortunately, the boiler was of tolerably uniform strength, and the result was a terrific explosion all around, demolishing the building, killing the engineer, throwing him through the front wall of a dwelling across the street, and also demolishing an adjoining house, killing two women inside of it.

This explosion occurred in the planing mill of Wilt & Son, at 711–723 North Front street, Philadelphia, and, as is customary, a coroner's jury had to "sit upon the dead bodies." Of this jury, Charles M. Cresson, M.D., of electric anti-incrustation humbug notoriety, appears to have been the central luminary, while of the other jurors four were experts in boiler making, and had earned great reputations from the bursting of their boilers and the killing of several persons thereby. The verdict of this jury is an astonishing production, when looked at from a common sense point of view. They very learnedly ascribe the incident to pre-existing causes, and found that the boiler had been repaired, and a defective sheet left in. Unfortunately for them, the iron of this boiler has, since the explosion, been tested, and found to be above the average strength, and the "defect" was found to be intact after the explosion, while Mr. Stephen Roper, a Philadelphia engineer, publishes in the *Times* of that city a statement that two or three of the experts on that coroner's jury are candidates for inspectors of steam boiler plates, while the others were "log-rolling" to get an order from Wilt & Son for a new boiler. So it is evident that they had an ax to grind.

This learned jury found another cause for the explosion in the hydraulic test. They say in their verdict: "The bursting of the boiler was the result of the use of an injudicious application of the hydraulic test, subjecting it to a testing strain which would have been improperly severe had the structure been wholly of perfect material."

Unfortunately again for these wise men, the hydraulic test applied by the Hartford Steam Boiler Inspection and Insurance Company was no more severe than that prescribed by law, which orders it to be 50 per cent above the steam pressure carried. As the latter was 80 pounds, the test applied was 120 pounds; so the test was neither *injudiciously applied nor severe.*

We ought to add to this that the above company do not favor the hydraulic test, and trust to other methods of inspection, often omitting the hydraulic test altogether; but in Philadelphia a local law compelled them to apply this test, which they did in accordance with the United States standard.

One of the Philadelphia papers says: "It is to be hoped, for the sake of common decency and out of regard to the intelligent character of our citizens, that it will be a long time before such an exhibition of humbuggery takes place in Philadelphia as that associated with the verdict of the coroner's jury presided over by Charles M. Cresson, M.D., in relation to the Wilt boiler explosion."

We need scarcely add that the Hartford Steam Boiler Inspection and Insurance Company promptly paid the $5,000 insurance for loss and damage.

This explosion is an exceptional accident in the business of that company.

EXPENSIVENESS OF ENGLISH PATENTS.—A writer in the London *Builder* complains that an English patent costs, in government duties, $125 within the first six months, then $250 within three years, and $500 within four more—total, $875 levied in seven years for a patent during fourteen years; while a patent in America costs only $35, in one payment, for seventeen years. He finally adds: "Thus are the brains of Englishmen handicapped against those of their rivals."

Iron vs. Wooden Ships.

It has been suggested as a reason for the present prevalence in England of iron ship building, that timber has become more and more scarce there, and must be imported from continually increasing distances—even across oceans. That this, however, is not the reason, is proved by the increase on this continent of the use of iron for the hulls of vessels, and the slackness of business in long-established ship-yards. Even the ferryboats running between New York and its suburbs are now built of iron. A few years ago the Union Ferry Company had two iron boats built—the "Fulton" and the "Farragut"—which have since been successfully running, while there are three iron ferry-boats plying on the Hunter's Point route, and another on the Houston street ferry.

The following parties have abandoned the business of wooden ship building: Edward F. Williams, of Greenpoint; Slack, Perrine & Patterson, and Webb, of New York, retired wealthy, while several smaller firms have ceased to exist. Others are still in the business, some of them prosperous to a greater or lesser degree; they are: Bird, Java street, Greenpoint, and James D. Leary, North Sixth street, Williamsburgh, who are building scows. Lawrence & Foulks make a specialty of steam ferryboats. The large firms of Englis and Steers still exist, but are doing much less business than in times gone by.

Experience is proving day by day the superiority of iron over wooden vessels. Instead of costing more, as was formerly supposed, they cost less; they require less skilled labor in their construction than wooden vessels, and a great deal more of the labor required can be done by means of machinery, as has been proved by Mr. John Roach in his iron ship yard at Chester, Pa., where he has introduced so many labor-saving appliances that he can build equally as cheap and good ships as are built in England, where labor is so much cheaper than it is here. The next advantage is, that for the same exterior size they afford more interior room, as wooden ships have to be partially filled with heavy beams and joints, which are absent in iron vessels, or rather, are displaced by far less bulky but equally strong, if not stronger, iron ones.

Again, another advantage is that wooden ships often need such repairs as scraping, calking, etc., while iron ships require far less repairing, and do not deteriorate as rapidly as those built of wood.

In regard to safety, opinions differ; some claim that when a wooden ship strikes a rock it cuts a hole in the bottom, splintering up everything around, while when an iron vessel strikes there is a strong chance that the iron plates will only be bent, and if the quality of the iron is good and the plates well riveted, there is far less liability of springing a leak than with wooden vessels.

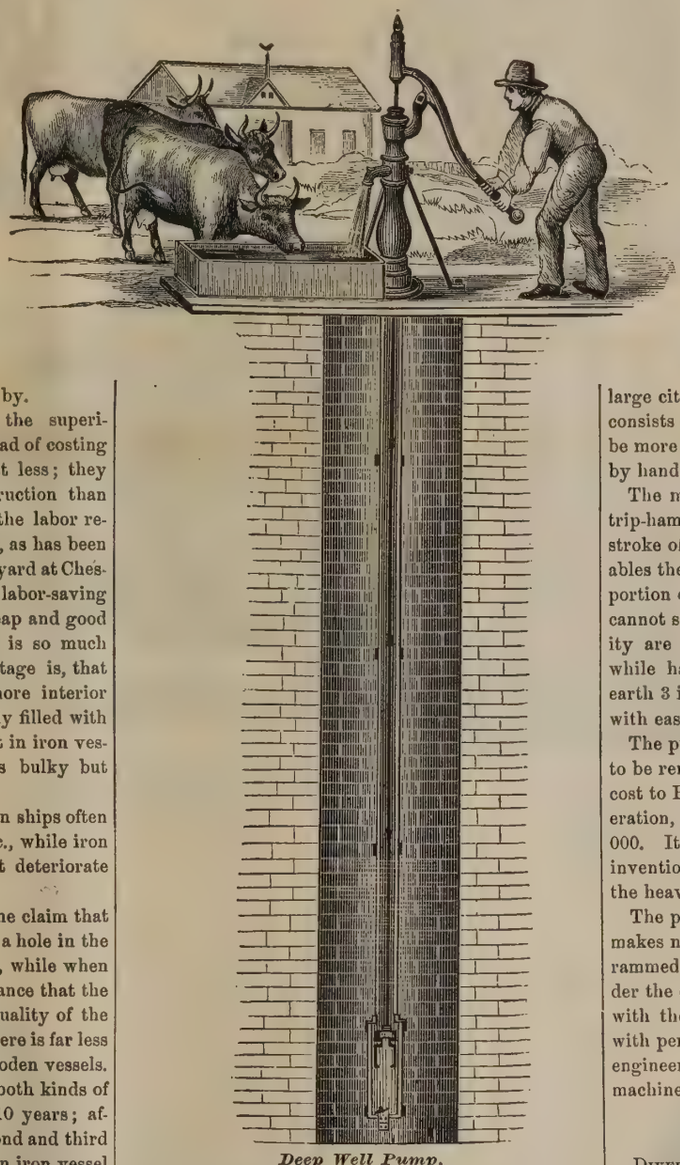
In regard to the insuring of cargoes in both kinds of vessels, a wooden ship is rated No. 1 for 10 years; after that she is compelled to carry only second and third class freight at heavy insurance rates. An iron vessel is rated No. 1 for 5 years; then, after inspection, she is again rated No. 1 for 5 years, and this repeated until she is 15 or more years old.

Smaller craft will for a long time continue to be built of wood, especially sailing vessels; but we are sorry to say that a great deal of this business has departed from New York harbor, where now the principal kind of work done is that for which there is great haste, our facilities, with dry docks, workshops, stock on hand, etc., being greater than those of any other city on this continent. But when parties have time to wait for the slow work done elsewhere, say in Maine, they find it cheaper. Among the causes of this difference are the strikes in which the New York workmen have repeatedly and unwisely indulged, resulting in the raising of prices and driving the business out of New York city.

Telegraphy Across the Caspian Sea.—The submarine cable for the Caspian Sea has just arrived at St. Petersburg. It is stowed in five boats, a sixth containing accessories and kitchen and dining-room for forty-five persons. The boats will proceed by the Neva, the Mary canals, and the Volga to Astrakhan.

Deep Well Pumps.

As suction pumps cannot lift water more than 30 feet at the most, when a well is deeper than this it is necessary to place the cylinder lower down—best not more than say 20 feet above the water level. The trouble, however, in this case is that the piston is out of reach, and when it gets dry so that the leather valves fail to close satisfactorily, the pump does not work well. In order to avoid this, it is better to place the piston, and the cylinder surrounding it, at the bottom of the well, so as to be always under water and thus prevented from becoming leaky.



Deep Well Pump.

The pump represented in our engraving is such a one, and is intended for wells up to 100 feet deep; it has been used for wells 150 to 200 feet deep with perfect success. The piston is attached to a series of rods, connected together, and at the top with the lever of the pump, while the cylinder is attached to a series of tubes, which surround the piston rod, and at the top are connected with the body of the pump.

After having been manufactured for more than twenty years, a demand sprung up for a heavier class of pumps of this kind—one strong enough to stand plantation usage and the severe handling that careless employees are accustomed to give. The present pump is the result of this demand.

We advise those who want such a pump to give the data to the manufacturers—such as the depth of the well, etc. As by increased depth the resistance of the lifted water to the piston becomes greater, and this in exact proportion to the depth, the piston and cylinder must be smaller as the well is deeper.

This pump is made by the Goulds Manufacturing Co., of Seneca Falls, N. Y., who have an office at 15 Park Place, New York, where can be found many other descriptions of pumps, with all kinds of requirements, such as pipe and fittings, driven well points, hydraulic rams, garden engines, jackscrews, siphons, etc. In fact, this company manufacture several hundred different varieties of force and lift pumps for every imaginable purpose. It is not surprising that their business at present has extended over all the civilized world, while they keep a full stock on hand of everything in this line for which there may be a demand. The different members of the firm have, by a long business career, earned the esteem of all those who have ever had dealings with them, for the fair manner in which they have always conducted their business transactions. All particulars regarding any of their manufactures will be furnished on application.

Paving Streets by Steam.

A steam rammer has lately been invented and patented, designed for paving streets in large cities where the greater portion of street surface consists of blocks and cobble stones, which require to be more firmly imbedded in the earth than is possible by hand.

The machine is operated on the same principle as a trip-hammer, and can be so regulated as to make a stroke of 1 pound weight or 1,500 pounds. This enables the operator to produce a level surface on every portion of the street, while the most expert man-power cannot strike over 200 pounds. Durability and solidity are the important features of paved streets, and while hand-power can only force the stone into the earth 3 inches, the steam hammer sends them 6 inches with ease, thus making the stone compact and solid.

The present mode of paving streets requires the work to be renewed on an average every three years. The cost to Philadelphia, where this rammer is now in operation, for re-paving the streets last year, was $135,000. It is claimed that the streets paved with this new invention will last until the stone is worn out, while the heaviest wagon or dray cannot affect the surface.

The present machine weighs 6½ tons, and even that makes no rut or impression on the street which it has rammed. In re-paving streets with cobble stones, under the old system, it is necessary to re-lay them, while with the steam hammer they can be driven to a level with perfect ease. It only requires the services of an engineer and a man to guide the rammer to work the machine, which consumes but ¼ of a ton of coal daily.

Diverting the Oxus River from its Present Course.—One of the numerous engineering problems which it has been left to this generation to solve, is the turning back, by Russian engineers, of the Oxus into its Caspian Sea channel, from which it was diverted into Lake Aral by Octai Khan, when besieging Khiva in 1235. Immediately after the Khiva expedition of 1873, a scientific survey was made of the Lower Oxus, and most of the experts were of the opinion that the progressive diminution of the river by artificial irrigation, and the evaporation consequent upon the destruction of the forests which shielded it from the sun, had made its volume insufficient to traverse an extra distance of nearly 5,000 miles incumbered with deep sand. It is now stated, however, that the experiment is actually being made; and the Lower Syr-Daria being only 12 inches deep in summer, the Russians may well do their utmost for the Oxus, as their only possible waterway into the heart of Central Asia.

Improved Turbines.

Next to the steam engine, no motor has attracted more the attention of experts in the mechanical art than the turbine, first invented in France by Fourneyron. Its main advantage in France was at first supposed to be that its revolving axis was vertical, like the axis of revolving grindstones in flour mills, and that therefore the gearing required to transmit the motion of the horizontal axis of over-shot and under-shot wheels, and of windmills, to a vertical axis, could be dispensed with. It was soon found, however, that the turbine worked to much greater advantage than any other water wheel, and gave a much larger percentage of the theoretical value of the maximum capacity of a stream than the wheels formerly in use. While with the old wheels only about 60 or 70, and often not more than 50 per cent was realized, the turbine gave 80, and often as high as 90 per cent; and it is quite natural that such favorable results should have been very encouraging and given a stimulus to extensive efforts to come still nearer to the realization of the full effect of the power at disposal.

When the turbine became known in this country, more varieties were produced here than perhaps in any other part of the world. The person who was perhaps earliest in its introduction and foremost in various modifications and improvements, was the late Mr. Jas. Leffel, of Springfield, O., who gave his name to a modification of the turbine, which is represented, with its cast-iron penstock, in the adjoined engraving, and now manufactured according to a contract made with Mr. Leffel, during his lifetime, by the firm of Poole & Hunt, of Baltimore, Md., who also manufacture steam engines, boilers, and various machines for saw, paper, flour, oil mills, etc.

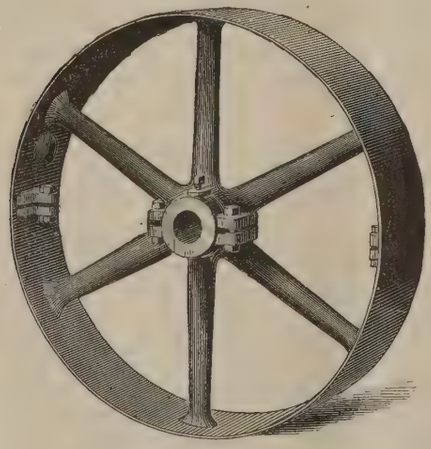


Fig. 2.

It may be well to state here that Mr. Leffel constructed and experimented with over one hundred different forms of water wheels, among which were the original outward discharge of Fourneyron, the vertical discharge of Jouval, the inward discharge, etc. Each class underwent in his hands numerous modifications in form, in the admission of the water, etc.; many had great merits—so many, indeed, as to make it doubtful which was best; but if the practical operation of the wheel, as experienced by those using it, is considered the test, the wheel here described stands foremost. It is now well known, that Mr. Leffel was the first to discover that a wheel may yield a high percentage of power in a test trial, and yet not be a good wheel for manufacturing purposes. The merit of this wheel is its reliability for the manufacturer.

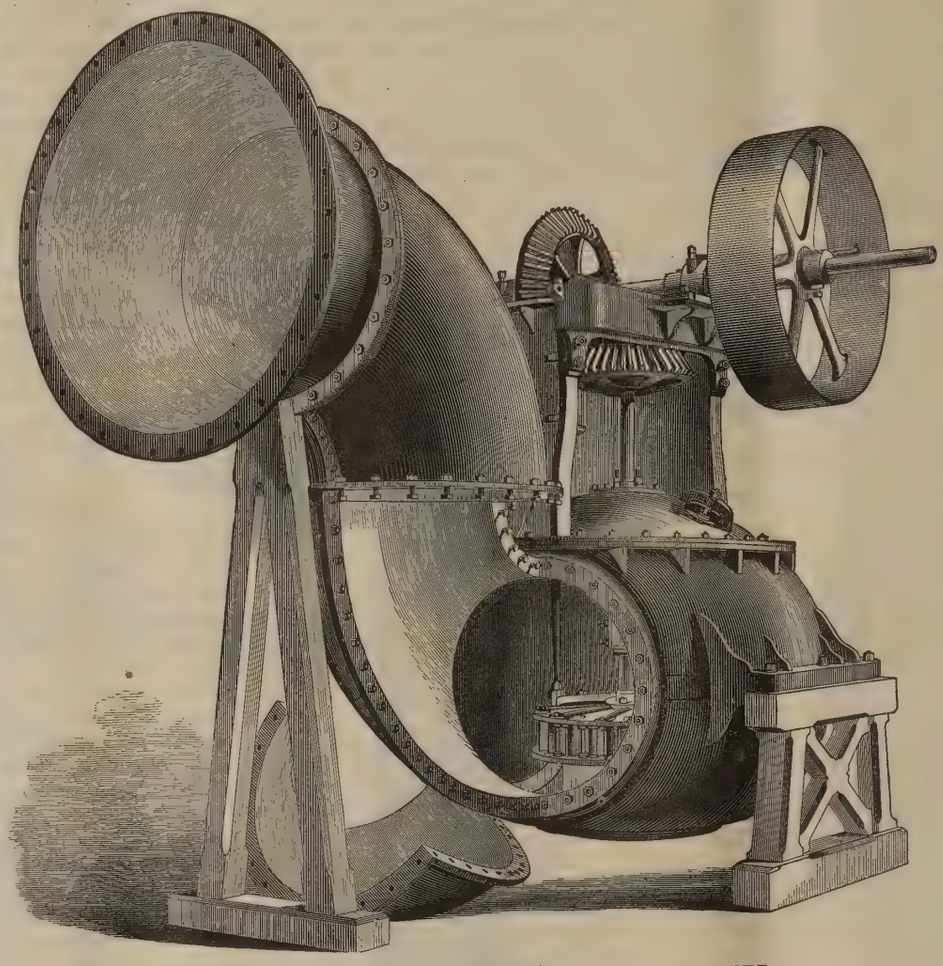


Fig. 1.—POOLE & HUNT'S LEFFEL TURBINE WHEEL.

Figure 1 represents this wheel as exhibited at our Centennial in 1876, while the illustrated catalogue of the masterpieces of that Exhibition, says:

"Messrs. Poole & Hunt, of Baltimore, exhibit several sizes of their Leffel turbine water wheels. We present an engraving of a 30½-inch wheel, contained in an ample spherical cast-iron flume or penstock, furnished with a movable cap, large enough to allow the passage of the entire wheel, if necessary, at any time for repairs. To one side of the penstock a cast-iron inlet pipe, with trumpet mouth-piece, is attached. The cast-iron penstock has been executed in superior style, reflecting great credit on the makers. In fact, all the parts of the machine have been manufactured with great care and precision, adding materially to its economy and efficiency: and the whole combination, in proportion and mechanical arrangement, is first class, thus securing the best results, both of efficiency in action and durability in use."

The reader will perceive that a peculiarity of this wheel is that the water enters all around its circumference, and is centrally discharged through the bottom. This, in connection with the peculiar arrangement of the penstock, secures many advantages; it renders the wheel fit to be used for very high heads from which which the water is discharged with great velocity; for this reason the castings are made extra strong, while a comparatively small wheel is all-sufficient.

Another advantage is the compactness of the whole arrangement, and the ease with which it is applied to the most diverse localities, the whole being sent from the factory with the wheel fitted in its proper position in the casing.

Again, another advantage is that there is total freedom from leakage, the casing being all iron, and, when compared with wooden casing, is almost imperishable; therefore such a wheel can be placed in the basement of a building and the water conveyed to it by pipes, while, by the absence of any leakage, everything around can be kept dry and clean.

The rotating shaft passes through tight stuffing boxes, placed in the cover or cap over the wheel, while the stuffing boxes are supplied with tightening bolts, so as to close them up whenever the least leak occurs by loosening.

It is evident that there are many circumstances under which the arrangement here described is the only one convenient. It is often the case that posts, foundations and walls cannot be removed in order to make place for the ordinary arrangements. Under all such circumstances it is preferable to use the compact iron penstock, which, when properly connected above with the supply pipe, and below with the discharge, occupies very little space in proportion to the power obtained. It is evident that the lower part may plunge into the water—in fact, it is advantageous to place it as low as possible, as for every inch it can be lowered it works under an inch higher head. We have only to add that these wheels have given great satisfaction wherever they have been used.

Messrs. Poole & Hunt, in addition to these turbines and a large variety of other machinery, make the manufacture of shafting, pulleys, hangers and machine molded gearing one of their specialties. We have before us an illustrated catalogue issued by this firm, devoted exclusively to this branch of their business, and we have selected for our illustrations the two styles of pulleys shown in Figs. 2 and 3. Their pulleys are all made from the best iron, selected for the purpose, and the facilities of the firm enable them to fill orders for large

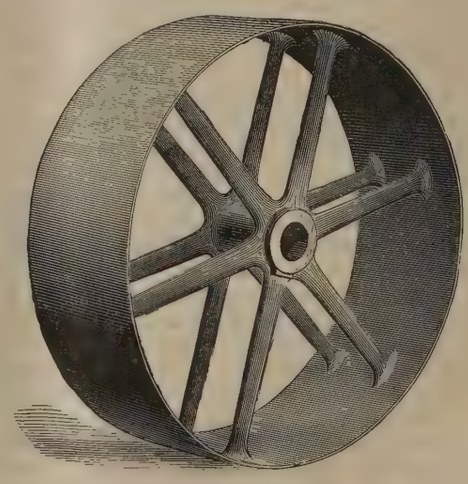


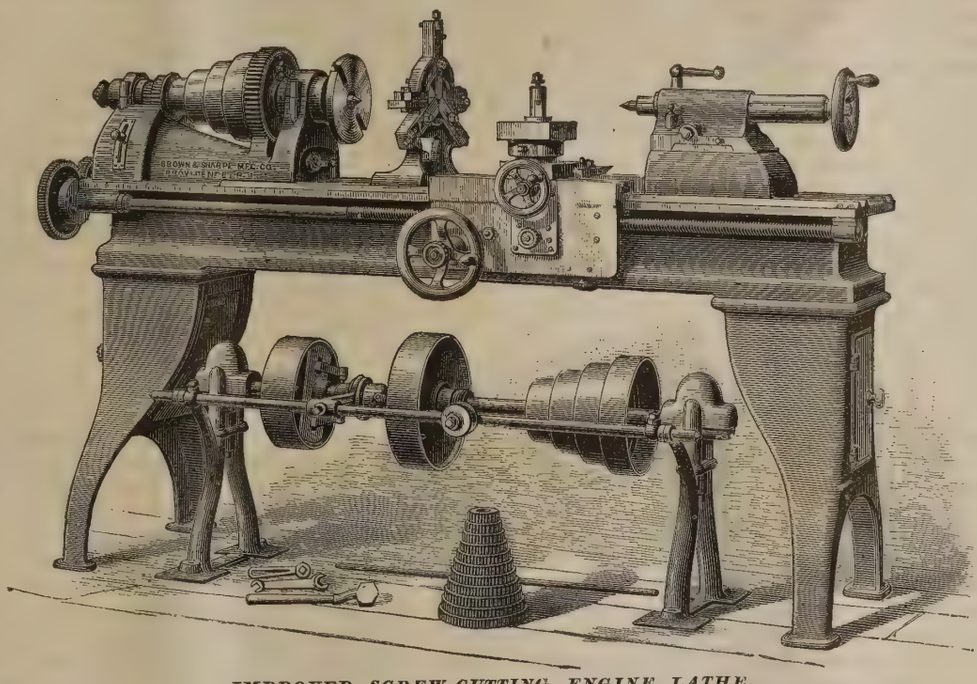
Fig. 3.

numbers of all sizes at very short notice. The following are the sizes manufactured by them: From 6 to 10 inches in diameter inclusive, increasing by half inches in diameter, and from 2 to 14 inches face, increasing by half inches of face. From 11 to 18 inches in diameter inclusive, increasing by inches in diameter, and from 2 to 14 inches face, increasing by half inches. From 19 to 37 inches in diameter inclusive, increasing by inches in diameter, and from 2 to 20 inches face, increasing by half inches. From 38 to 60 inches in diameter inclusive, increasing by 2 inches in diameter, and from 6 to 24 inches face, increasing by inches. From 60 to 84 inches inclusive, increasing by 6 inches in diameter, and from 6 to 24 inches face, increasing by inches. From 84 to 144 inches in diameter inclusive, increasing by 12 inches in diameter, and from 6 to 24 inches face, increasing by inches.

Messrs. Poole & Hunt not only furnish their pulleys and gearings to mill owners, but ship car loads of castings to other machinists and dealers both East and West.

Improved Screw-Cutting Engine Lathe.

The engraving illustrating this article represents one of the most perfect and complete screw-cutting engine lathes thus far manufactured. It is a product of the Brown & Sharpe Manufacturing Co., and can be obtained at the George Place Machinery Agency, 121 Chambers and 103 Reade streets, New York, a depot for the sale of machinists' tools and machinery.



IMPROVED SCREW-CUTTING ENGINE LATHE.

The lathe here represented, has, besides the well known devices of those in common use, others which render it especially desirable for use in a tool room, or for any fine and accurate work. It is driven by a 2¼-inch belt, and is strongly geared, the gears, which are usually placed at the back of the head, being underneath it and entirely enclosed, making a neat and cleanly arrangement. They are thrown in contact by the lever shown below the spindle at the front of the head. The spindle and boxes are of steel, hardened and accurately ground; the boxes have means of adjustment in case of wear, and are self-oiling; the journals are 2 inches in diameter and 4 inches long; the spindle has a hole through its center ¾ of an inch in diameter, which is a convenience when the lathe is used for cutting up stock, or for finishing the ends of long work. The carriage is gibbed to the bed, and has a clamp screw to hold it firmly when using the cross feed. It is also planed to a level surface on top, and has T slots for convenience in holding work when boring. The screw and change gears will cut all threads from 3 to 16, and nearly all from 16 to 48 per inch. The split nut upon the screw is opened and closed by a hand wheel underneath the apron. The tail stock is also gibbed to the bed, and having a cam fastening which is quickly operated, it can be moved on the bed without the annoyance usually experienced. The hand wheels operating the carriage, cross feed screw, and tail stock spindle, are graduated on their hubs. A stop screw is permanently attached to the cross slide, which is used without any change for either inside or outside screw cutting. This lathe will swing over the bed 16 inches and over the carriage 11 inches, and one with 6-foot bed will take 2 feet 10 inches between centers. The overhead works are furnished with the peculiar friction pulleys patented by the manufacturer. A compound rest, which is easily applied to the lathe, in place of the elevated rest, is furnished at an additional charge. Suitable closets, arranged for holding the change gears, wrenches, and tools, are fitted in the legs.

The price of this lathe complete, with the overhead works, ready for shipment, is, for a 6-foot bed, $500; for a 7 and 8 foot bed, an additional charge of $10 per foot is made.

PHOSPHORESCENT PAINT PATENTED.—It is reported that quite recently a patent has been secured in England for the use of phosphorescent salts, such as sulphid of lime, of strontium, of barium, etc., for the purpose of illumination by mixing them with paint or varnish for wall papers, coating house fronts to make them luminous at night, etc., as was suggested by us on page 67 of our March number for 1878. At present the patentee only covers clock faces to make them visible at night, but by his new patent he claims it for all kinds of lighting purposes—streets, ships, buoys, and also objects in the signal service. Our readers must know that this class of substances possesses the very curious and interesting property of storing up light from the sun or electrical discharges, and gradually radiating it out when it is dark.

Bessemer Steel vs. Iron.

The statistics of our iron production show strikingly how the improved process invented by Bessemer is gaining ground, and this at the expense of the older methods. At the close of 1877, the number of abandoned iron furnaces in the United States was 446, while the number in blast was only 270. The check to this immense industry was greatest in Indiana. That State had eight blast furnaces in operation in 1872, and produced in that year 39,221 tons of pig iron; two of these furnaces have been dismantled, two have been removed to Cleveland, O., and one or two more will be torn down this year. The pig iron product of Indiana fell to 15,640 tons in 1877.

On the other hand, the Bessemer steel industry developed to the point of independence of foreign competition, but not having yet reached the destructive point of home competition, or of over-production, has steadily advanced.

The first British steel rails sold in this country, in 1863, commanded the great price of $150 a ton in gold. In 1867, when American steel rails were first made to fill orders, English steel rails fell immediately in our markets to $118 gold. As the result of the competition thus established, the price of Bessemer steel rails has steadily and rapidly declined, until, in 1877, the American make was sold as low as $40 a ton, with an average for the whole year of $45.50. In 1878 they fell to $42.25. The price of Bessemer steel rails is now less than half the price of iron rails at so recent a period as 1872.

The American Bessemer rails are in all respects as good as the English. The number of Bessemer steel works in the United States is eleven—one in New York, five in Pennsylvania, one in Ohio, and three in Illinois; all are in full operation, with orders ahead for a year, except one is Missouri, which is idle for a special reason. It is a very interesting fact in the development of American industry that the Bessemer steel manufacture should have moved forward with such prodigious vigor during the entire period of depression, bankruptcy and liquidation between 1873 and 1878. This remarkable development is shown in the figures representing the production of steel rails in this country since 1867, when we began making. We made in 1867, 2,550 net tons; in 1868, 7,225; in 1869, 9,650; in 1870, 34,000; in 1871, 38,250; in 1872, 94,070; in 1873, 149,015; in 1874, 144,944; in 1875, 290,863; in 1876, 412,461; in 1877, 432,169; in 1878, 550,398.

The average yearly prices per gross ton at which standard Bessemer steel rails have been sold since 1868, are as follows: In 1868, $158.50; in 1869, $132.25; in 1870, $106.75; in 1871, $102.50; in 1872, $112; in 1873, $120.50; in 1874, $94.25; in 1875, $68.75; in 1876, $59.25; in 1877, $45.50; in 1878, $42.25.

There has been a similar steady reduction in the price of our iron rails. The highest figure at which they were ever sold here was $153.75, in September, 1864, the average price for that year being $126. From that time iron rails steadily declined to the average for 1872, of $85.12½ a ton gross; advanced for awhile in May of that year to $90.50, thence declined steadily to $32.50 in October, 1877. That was the lowest price at which they were ever sold in this country.

Chinese Politics.

According to Barnes's *Educational Monthly*, the population of China is over 400,000,000, of which there is scarcely one who cannot read and write, notwithstanding the drawback of having to learn at least 3,000 letters. Their colleges number 2,000, while in the way of public libraries they have a hundred times as many as we have; but as their population is ten times that of ours, their libraries out-number ours ten to one in proportion to population. Education, however, is defective, as in China it is even more a discipline of memory than it is with us.

But one excellent thing, however, is that no public functionaries are appointed by election, but are chosen from the best graduates of the colleges, to which only the best pupils of the public schools are admitted, to be further educated. The result is that there are no wire-pulling political parties, nor ignorant functionaries, but to be appointed to office is a real honor and a public acknowledgement of acquired talent.

Building Intelligence.

NEW YORK CITY BUILDING ITEMS.

On the east side of New York city, where the population is much crowded together, an improved plan of tenement house will receive a fair test. The work of erection began May 1 at the southeast corner of Monroe and Corlears street. A lot of old rookeries which formerly stood at this point were pulled down, and the ground was excavated to a depth of twelve feet below the sidewalk. Then upon a foundation of cement and broken stone eighteen inches thick and four feet wide heavy double walls were built. The projectors are Jackson S. Schultz, R. M. Strebeigh and T. B. Thomas. Mr. Schultz wishes it to be considered that this is by no means a charitable undertaking, but a business enterprise in every sense of the word. To such people as agree to keep their rooms in good order and observe the sanitary rules of the house, sets of rooms will be rented varying in price from $8 to $10 a month, intended, of course, for the artisan and mechanic class. The main front, of brick, with trimmings of polished blue stone and slate, will be on Monroe street, towering sixty feet high, the front walls reaching an altitude of sixty-five feet above the sidewalk and capped by two towers, one in the center of the Monroe street front and the other on the corner of the building. Projecting about four feet from the main front of the building will be a central tower extending from the street to the roof, and in this will be a circular stairway, enclosed fire-proof brick walls, giving access to each floor. Balconies on either side of this tower give access to the rooms on each floor, the stairway being completely enclosed by the fire-proof wall, and having no direct connection with the rooms. It is proposed to divide alike the second, third, fourth, fifth and sixth floors, the first floor being used for stores with dwellings in the rear. Washrooms 3x6 feet, containing stationary tubs and a bin for coal and wood, are arranged in small towers running up to the roof at the rear of the dwelling rooms. Light and ventilation will be here had by large windows, and a water closet for each family will also be provided in the tower. The trouble of carrying ashes in pails to the sidewalk is to be obviated by a shute into which they can be emptied from the different rooms. To receive the ashes light pits are provided in the cellar connecting with the shutes, the latter being closed by iron air tight castings to prevent the unpleasant escape of dust or ashes into the rooms. In the construction of the walls much care has been taken. The partition ones will not rest on the floor beams, but on cast iron supported by pillars resting on a solid brick wall built upon a concrete foundation. When people remember the flimsy way in which tenements have been run up in this city this will appear an unusual degree of precaution, but the effect will be to spare the danger of the partition walls settling and cracking the plaster. In all the walls at the hight of four inches from the cellar floor a course of slate has been laid with a view of preventing moisture from the ground entering and thereby injuring the walls. There will be nineteen large, airy rooms on each floor, divided into sets of two and three rooms each, the smallest of which will be sixteen feet long and seven feet wide. The roof is intended to be flat, and protected by a iron railing, so that the children may play on it without running any risk of falling off. The rooms in the square tower at the other end of the main front will have double windows, and each window in the building will be formed of a single pane of glass. It is thought that the building will be ready for occupation some time during the month of October. It will be in charge of a family who will have rooms on the first floor. It is certain that if this enterprise proves a financial success, similar buildings will be erected in other parts of the city.

The Van Corlear apartment house fronting the entire block on Seventh avenue, from Fifty-fifth to Fifty-sixth street, shows the progress we are making even in the construction of this class of buildings. It is the only one, in fact, or rather the first which has a court-yard worthy of the name and such as the Parisians understand it. True there is not yet the *porte cochere*, but, nevertheless, all the other appurtenances are there, and the court itself extends over 3,500 square feet and an entrance is provided for wagons that can find access to the place by a roadway especially constructed for that purpose. Fronting, as already stated, on Seventh avenue, this apartment-house extends one hundred feet on each side of the street, where the two main entrances are leaving an entire unbroken line along the avenue. The structure rises to immense proportions with its six stories and attic of Philadelphia brick, but there the eye is greatly relieved by the terra cotta and other trimmings that ornament this vast front. Coming back to the court-yard, which contains a fountain, we find that the entrance above alluded to is on the west side, and a paved passageway connects this court with the street, the yard proper being laid with an asphalt pavement. It is from this court that the practical utility of the Van Corlear can best be contemplated. Each of the six stories of the building contains six suites of rooms, and each suite has at least nine, and a few have ten rooms. Not a single dark room can be found among these thirty-six suites of apartments, either the room has a window on the avenue or side street, or on the vast court-yard. The principal rooms are in all cases near to the entrance and the kitchens so disposed as to be quite unobtrusive. Ample coal and wine cellars have been provided and a separate drying room for each suite will be found in the attic. Brick walls separate each suite of rooms and the various partition walls are of strong, fire-proof material. That a building of this description is eagerly wanted in New York is evidenced by the fact though the Van Corlear will not be ready for occupancy before October 1st, nearly all the suites have been disposed of to excellent tenants at rentals ranging from $1,000 to $1,500. The owner is Mr. Edward Clark, President of the Singer Manufacturing Company, who has expended $300,000 on the construction of the building. The architect is H. J. Hardenbergh, of 111 Broadway, who claims his production as a pure Renaissance with considerable of the Queen Anne feature about it.

An important addition by Peter Cooper to the Cooper Institute building is contemplated. For a long time there has been a pressing demand in Cooper Institute for more room. More students knock at its doors than can be accommodated with the present facilities. The accommodations for the schools of sculpture, architecture and painting have been especially overtasked, and Mr. Cooper has decided to respond to the demand for the enlargement of the building. A new story with an immense dome, as contemplated in the original plan, will be added to the 100 feet hight of the present building. The pedimented cornice which now crowns the fifth and top story of the building will be left as it is. The brown stone walls will be carried up twenty feet above it to form the additional attic story, and rows of large, handsome windows will look out on the streets. A heavy metal cornice will cap the seventh story, and from the center will rise the large metal dome. The building then will be seven stories in hight, and it is expected that a fine architectural effect will be secured. In the original plan it was intended that the Cooper Institute should be surmounted by a dome for astronomical purposes. This will now be added chiefly for the outside architectural effect, but at the same time it will greatly increase the effect of the imposing room on the upper story.

The open garden connected with Koster & Bial's Concert Hall, on 23d street, is to inclosed for the winter, and will be as elaborate in finish as the main hall. The architect is H. J. Schwartzmann, late architect and chief engineer of the Centennial Grounds.

St. Ann's Church, in Astor Place, is being torn down inside, and after reconstruction will be known as Aberle's Tivoli Theatre.

C. H. Doescher will have built immediately a factory 50x80 feet, on Marion street, near Spring. Wm. José, architect.

H. H. Richardson, of Brookline, Mass., has drawn plans for a large apartment-house to be erected at the corner of Forty-first street and Broadway.

Workmen are now excavating on Fifty-seventh street, preparing for a residence to be built for Wm. H. De Forest. It is to be of brick, with stone finish, and will cost about $45,000. Lamb & Wheeler are the architects.

MISCELLANEOUS.

Michner & Co., of Cincinnati and Philadelphia, will build a large packing-house, 300x400 feet in Chicago, on Packers' avenue, at the Union Stock Yards.

Parke, Davis & Co., are building in Detroit, Mich., a new factory at the foot of McDougall avenue, which is to be two stories high and 63x246 feet in size. It will cost about $13,000.

Lloyd & Pierce, architects, are to build, for Newberry & McMillan, at Detroit, Mich., a five-story stone building, 80 feet square, which will be called the Rotunda Building; cost, $160,000.

The foundations for a new fifteen-room school-house in Chicago, at the corner of Ohio and Oakley streets, have been laid. The building will be completed by January 15, 1880, and will have a capacity for 1,000 children.

The congregation of St. Barnabas' Protestant Episcopal Church at Baltimore, Md., intend to erect a parsonage at the corner of Biddle street and Argyle avenue. The building will be of fine pressed brick, three stories high, with mansard roof.

The work of completing the Capitol dome, at Hartford, Conn., has commenced, and the copper roofing is finished. The plastering of the rotunda is in progress, and the repairs on the dome piers will be hurried forward as rapidly as possible, but in spite of the finest workmanship the inserted plugs of granite, necessary for filling the drill-holes for pouring in type metal, will remain visible.

The Masons and Odd Fellows at Newcastle, Del., have purchased ground at the corner of Delaware and Vine streets, and are making active preparations for building a new hall. T. P. Chandler of Philadelphia is the architect. The building will be 50 by 100 feet and 51 feet to the top of the dome. The first floor will contain stores, the second a large hall, capable of seating 600 people while the third floor will contain the lodge-room, ante-rooms, etc.

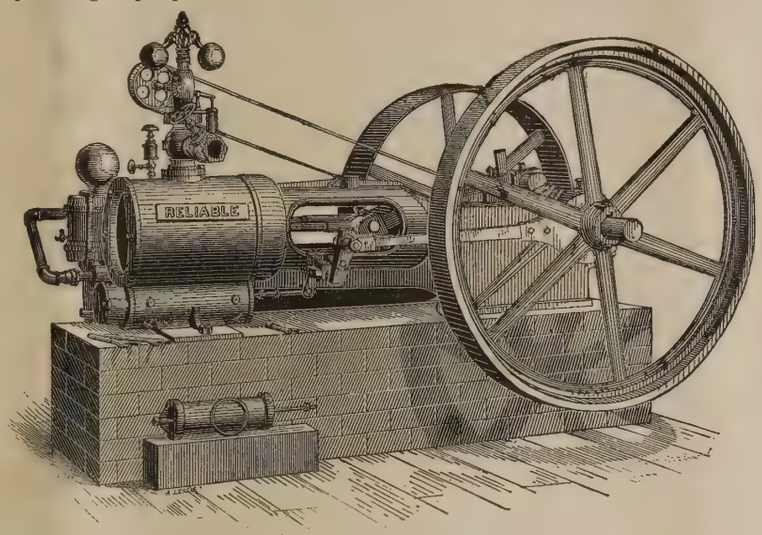
James R. Willet, of Chicago, has prepared plans and specifications for an addition to the Insane Asylum at Kankakee, Ill. It will be a fire-proof building, 200 feet in length by 50 feet in width. All the partition walls are of brick, and the only wood-work used is in the roof, which is separated from the building by iron-work and masonry. This wing will be three stories high. Besides this wing there are three detached wards for the occupation of officers of the institution and those of the insane who require less restraint. The appropriation for these additions to the asylum is $160,000.

The Vassar Brothers, of Poughkeepsie, N. Y., nephews of the founder of Vassar College, have commenced the erection of a Home for Old Men in that city, and the work on the building is proceeding rapidly forward. The structure is to be three stories high, with basement and attic, and will front on Vassar street, a broad flight of granite steps running down from the front portico halfway to the street, where from a broad platform two narrower flights run down to the sidewalk. The west and south elevations will each present an imposing front, the western portico being elegantly ornamented with fine wood work, and massive turned pillars and neat balustrades, and the southern portico, which extends from the basement to the third story, being correspondingly trimmed. The entire building is to be of Poughkeepsie pressed brick, with granite trimmings, and a neat and impressive cornice. The entire building is to be lighted with gas and heated by steam. The roof is to be of tin, but will be broken up by angles and gables so as to give a lightness and variety to the upper part of the building. J. A. Wood is the architect, Arnout Cannon the builder, and Henry W. Otis of Kingston the mason.

Improved Double Crank Steam Engine.

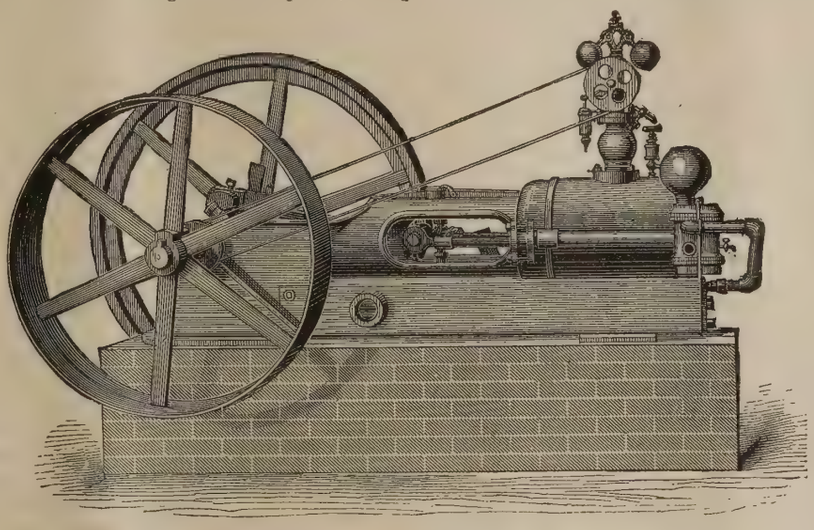
The steam engine of which the adjoined cuts give a front and rear view, is claimed to be the cheapest engine yet built, as it costs only $12.50 per horse-power, and we do not think that a complete and perfectly reliable engine, as good as any ever made for durability and constant hard work, has ever been built at this rate heretofore.

The way in which this has been accomplished by the makers, Messrs. Heald, Sisco & Co., of Baldwinsville, N. Y., is that they have set out by making a design of a good, solid, 20 horse-power, stationary, horizontal engine, complete, with feed pump, water heater, governor and throttle, cylinder, lubricator and balanced slide valve. In this design, which was as novel as it was graceful, great care was taken to secure a judicious distribution of material, so that nowhere should any dead weight be present; the material used was only applied in abundance where it was needed to resist the strain, and so shaped as to resist it most effectively and economically. The absolute rigidity thus obtained with the greatest practicable lightness, secures that durability and economy of wear which is absent in many other engines, where, from the want of the precautions mentioned there is vibration and even noise when in rapid motion. After the design had been decided upon, the manufacturers adapted the large facilities which they had obtained in manufacturing the famous "Heald & Sisco Centrifugal Pump," to the building of this one size of engine exclusively—a 20 horse-power for $250, as contemplated from the beginning, being the size for which there is the most demand. This gave an enormous advantage over manufacturers who have to make large investments in tools, patterns, etc., necessary for the production of a multiplicity of sizes and styles, which has been the ruination of many large and expensive establishments; having so much capital invested, they could not, when prices came down, compete with smaller concerns who had practiced economy, and not grown beyond the resources of their trade.



Complete 20 Horse-Power Steam Engine—Front View.

Our engravings show that the engine is of the horizontal kind, and that the open casting surrounding the piston and connecting rods, and connecting the cylinder with the bearings of the shaft, makes it impossible to ever throw the parts out of line. Requiring a floor space of 7 by 2 feet only, they are more compactly built than any other horizontal engine of equal power, and from the shortness of stroke and great strength of parts, admit of a very high rate of speed.



Complete 20 Horse-Power Steam Engine—Rear View.

The cylinder is steam jacketed, with steam chest on the bottom, giving perfect and instant drainage, and all cast in one piece. The piston is packed with self-adjusting inside and outside metallic rings, and also the valve, which, while simple and inexpensive in construction, gives results equal to any not supplied with variable automatic cut-off. It is as perfectly balanced as one running in a horizontal position can be made, and requiring the minimum of power for its operation; it exhausts through its center into the heater, giving no pressure on the steam chest covers, nor leakage at any point. No better valve for engines of this capacity can be made.

The boiler feed pump is as simple, positive and durable as can be devised, accessible in case of stoppage, by simply loosening one nut and without disconnecting the pipe. The water heater is a separate part, and so attached as to have no effect from its expansion and contraction on other parts, and has perfect drainage. The engines are furnished with the Waters' governor, which can be adjusted while the engine is in motion. The crank shaft, connecting rod, and straps are of best forged iron; best anti-friction metal for shaft boxes, and bronze metal boxes for both ends of the connecting rod; steel cross-head, with steel wrist and bronze metal gibs, adjustable to wear; piston rod, valve rod, pump rod of steel—in fact, all the material used is strictly first-class, and the fitting up as perfect as the best facilities and mechanical skill can give. All parts are made in duplicate, so that worn or broken parts may be readily and cheaply supplied and accuracy of fit assured.

The fly wheel is 53 inches, weighing 700 pounds, with either a 40 × 10 or 50 × 10 inch band wheel. Total weight, 2,700 pounds. The engine is guaranteed to give 20 horse-power, cutting off at three-fourths stroke, with 70 pounds of steam; it can be run at 250 strokes per minute with perfect safety, and should be run at not less than 180 to develop rated capacity.

Those requiring engines of this capacity can unhesitatingly send their orders, with the assurance of getting as good an engine in all essential points as can be bought anywhere.

Every engine is thoroughly tested by actual running before shipment, and its perfect and thoroughly satisfactory performance guaranteed by the manufacturers, who are meeting with so great a demand that they are unable to keep ahead of their orders. Several certificates have been submitted to us from United States engineers and others expressing their perfect satisfaction with these engines, they having in every case sustained the claims made for them.

Life-Saving Apparatus.

The work performed by the crews of the United States Life-Saving Service has been a very important one—far beyond its cost, even though nothing but the saving of vessels and cargoes was to be considered. The disasters of last year were greater in number and severer in character than the service has ever before encountered—a fact established by the record of 171 disasters within life-saving limits, against 134, the highest number of any former year, and 59 vessels and cargoes totally lost, in contrast with the highest antecedent record of 34.

The system as it now exists has been in operation since 1877, during which time there have been, in the field covered by the service, 578 disasters. The total value of the vessels wrecked was $8,800,457; the value of cargoes, $4,957,684; value of property saved, $8,065,322; value of property lost, $5,656,819; number of persons on vessels, 6,287; number of persons saved, 5,981; number of persons sheltered, 1,382; number of days shelter afforded, 3,716; number of lives lost, 306, of which 183 were lost by the disasters of the steamers "Huron" and "Metropolis," last year. The first of these wrecks occurred before the opening of the stations under the provisions of law, and the latter between two stations, at such a distance from either as to greatly hinder successful operations—conditions which had long been indicated by the officers in charge of the service as pregnant with fatality.

The working force of the service is employed at 148 stations, distributed along the coast as follows: In Maine and New Hampshire, 6; Massachusetts, 14; coasts of Rhode Island and Long Island, 36; coast of New Jersey, 39; coast from Cape Henlopen to Cape Charles, 6; coast from Cape Henry to Cape Hatteras, 10; eastern coast of Florida, 5; Lakes Erie and Ontario, 9; Lakes Huron and Superior, 9; Lake Michigan, 12; Pacific coast, 2.

For several years much attention has been given by the department to the invention of improved apparatus for saving shipwrecked crews. Although the range which was attained with the shot-line by the mortars in use at the stations previous to late improvements, was somewhat greater than that of the ordnance used by the life-saving institutions of other countries, as the features of the coasts where the latter operate generally require less for the contingencies of shipwreck, the occurrence of some sad disasters by the stranding of vessels barely beyond the reach of our shots, have demonstrated the great necessity of extending it. The latest and most successful efforts have been those of Lieut. D. A. Lyle, of the Ordnance Department, United States Army, who was detailed to that duty by the Chief of Ordnance, in June, 1877.

The problem to be solved was not only the attainment of the desired increase of range, but this with ordnance and equipments of the least possible weight and best adaptation to the exigencies of practical application. In conducting his experiments with a view to the solution of this problem, Lieut. Lyle was charged incidentally with the determination of the kind of powder, and the charges to be used under different condi-

tion, the size, material, and texture of the best shot-line, the best form and size of faking-box, and the proper relative positions for the faking-box and gun in firing.

His labors have been signally successful. The greatest range of the shot-line ever before attained, so far as known, is 631 yards. This was with a mortar gun, weighing, with its bed, 535 pounds, the shot, in addition, weighing 33 pounds, making a total weight of gun and projectile of 568 pounds. This weight is too great for transportation with the other necessary apparatus from a station to a wreck occurring at a distance, by a few men composing a life-saving crew. There are but two of these guns in the service, one being placed between two stations at a specially dangerous point, the other at one of these stations.

In the course of former experiments in the service, another gun had been developed, weighing, with its bed, 288 pounds, with a projectile of 22 pounds, making in all 310 pounds, which has given an experimental range of 473 yards. Twenty-five of these guns are in the service. The maximum range obtained by experiment with the mortar in general use in the service, which weighs, with its bed, 288 pounds, and carries a shot weighing 24 pounds—total, 312 pounds—is 421 yards.

Lieut. Lyle has devised a gun and shot, the entire weight of which is 202 pounds, (mortar and bed weighing 185 and the shot 17 pounds), which has attained a maximum range of 695 yards. It will be seen that the gain in range over the first mentioned gun is 64 yards, with a reduced weight of ordnance of 366 pounds; over the second gun, 222 yards, with a reduced weight of ordnance of 108 pounds; and over the mortar in general use, 274 yards, with a reduced weight of ordnance of 110 pounds. A smaller gun has been devised by the same officer, which will secure the range required in places where less power is needed. The latter gun, with its carriage, weighs but 89 pounds and the projectile 13, making a total weight of 102 pounds, and has thrown a line 477 yards.

It should be borne in mind that these figures express the extreme limit which has been reached in the course of all the experiments, and that they cannot be repeated at will. They indicate, however, the general ratio of increase of range secured.

Steam Boilers—Their Good Qualities and Defects.

The following is an extract from a very instructive lecture, given at Hartford by Mr. J. M. Allen, President of the Hartford Steam Boiler Inspection and Insurance Company:

"Very few people, while looking at, admiring, and wondering at the famous Corliss engine at the Centennial Exhibition, stopped to think of the source of its power and energy—few recalled the fact that all this splendid machinery derived its motive power from the concealed steam boilers in the low line of buildings outside the Main Centennial Hall. In crossing the Atlantic in an ocean steamer, how few think of the unsightly, unattractive boilers that furnish the power for the machinery that carries the vessel forward.

"In discussing this question, it is proper that we should know of what materials boilers are constructed, and the methods of their construction. In the manufacture of iron plates it is necessary to obtain an iron ore free from phosphorus and sulphur, the former making a 'cold short' iron, and the latter a 'red short,' either of which is unsuitable for boiler plates when high pressures are to be used. In the process of 'puddling,' 'shingling,' repeating and rolling into finished plates, the presence of slag or scoria on the bars composing the pile prevents perfect welding."

The method of making boilers was then explained, and the defects from poor workmanship pointed out and illustrated by specimens. The lecturer devoted considerable time to the discussion of chipping and caulking, showing that by the old methods boilers were liable to be very greatly injured and incipient defects developed. He recommended the planing of the edges of the sheets preparatory to caulking in preference to the old method of chipping. The necessity of having good material and good workmanship in the construction of boilers was brought more forcibly to the minds of his hearers when he stated that a boiler 16 feet long, 60 inches in diameter, and running at a pressure of 60 pounds to the square inch, sustained an internal pressure of not less than 1,000 tons, the tendency being to burst the surrounding metal asunder. He also stated that railroad locomotives carry a pressure on their crown sheets of not less than 90 tons. It is not to be understood that these are dangerous or excessive pressures, but are mentioned to give some adequate idea of the immense strain to which steam boilers are subjected, and also to show the absolute need of the best material and workmanship in constructing them. Anything short of this is criminal neglect.

Mr. Allen then proceeded to show at what pressure a boiler may safely be worked. He stated that there were formulas for all these, so that the bursting and safe working pressure could be easily arrived at. He further showed that the bursting pressure of the boiler above mentioned—16 feet by 60 inches—was not less than 525 pounds to the square inch, but that in practice only one-6th of the bursting pressure should be allowed, leaving a wide margin for safety. This would admit of about 87 pounds of steam to the square inch as the safe working pressure of this boiler. At this point the subject of water used in boilers was taken up, showing that much solid matter, carried in solution, was precipitated by high temperatures. The carbonate of lime, sulphate of lime, carbonate of magnesia, aluminum, and other chemical ingredients, cause a hard, indurate scale, which adheres to the fire sheets of the boiler, greatly reducing the economy in fuel, and rendering the plates liable to severe over-heating and consequent great reduction of strength.

The internal corrosion of boilers was next discussed, showing that this was caused by impurities in the water. Manufactories situated on the banks of a stream discharging their refuse and spent dyes into the current, render the water extremely impure. It will be readily seen that if those manufactories which are situated lowest down on the stream fill their boilers with this water they will have a very impure and dangerous liquid from which to generate steam. Cases of severe and dangerous corrosion were mentioned as arising from this cause. Specimens of corroded plate and braces were shown, where the iron was nearly wasted away, and yet it was stated that the parties owning the boilers had rested securely in the belief that their boilers were sound and well braced. These defects were discovered by careful inspection, a means of safety too often inadequately performed, or neglected altogether. The methods of inspection were next discussed, and it was stated that in all cases where it was possible, boilers should be examined internally as well as externally. Inspection by the "hammer test" was described, showing that a practiced ear, from light blows on the sheet, could detect defects in the material. The weaknesses arising from wear and tear can only be discovered by the most careful internal and external inspection. Carelessness in the management of the safety valve was considered, and instances of overloading them far beyond the limit of safety were mentioned. In one instance a steam user was found to have wedged his safety valve down by driving a stick between the lever and the beams of the building overhead. The principle of the steam gauge was described, and its importance in connection with the use of steam boilers; also its liability to defects and variations, which can only be detected by comparing it with a gauge known to be correct. This process of comparison was illustrated by very unique apparatus, prepared expressly for use by the Hartford Steam Boiler Inspection and Insurance Company. The standard by which these test gauges are corrected is a mercury column, which is invariable and therefore reliable. The column in use at the company's office, which the lecturer described, is inferior to none in the country.

Mr. Allen next considered ebullition, the conduction of heat, and the generation of steam. When pressure is suddenly released, a great disturbance follows within the boiler; the water may be projected against the sides of the boiler at a velocity approximating 2,000 feet a second, which was considered sufficient in most cases to account for the terrific explosions which rend boilers in pieces, throwing portions of them hundreds of feet. Instances of terrific explosions were cited and photographs illustrating them were exhibited. Mr. Allen touched briefly upon the proposed theory of the spheroidal condition of water, repulsion, and deærated water as the cause of mysterious boiler explosions. His opinion was that we need not look for mysteries in this matter, when we consider that there are so many things to decrease the ability and working age of a boiler, arising from poor material, inferior workmanship, and careless management. Brief allusion was made to the explosion of the steamer "Adelphi," by which sixteen lives were lost, and an explanation given how this disaster might have been prevented by thorough inspection and timely repairs.

The lecturer closed with a brief history of the formation of coal, the carboniferous age, the wonderful growth of plants, the absorption of carbonic acid gas from the atmosphere, all energized by the rays of the sun, as, according to the present recognized theory, all the energy in coal is derived from the sun, the primative source of all power.

The Poughkeepsie Steam Catamaran.

One of the peculiar double vessels called "catamarans," used by some of the savage tribes in the Pacific ocean, is now being built at Poughkeepsie, N. Y. Several improvements on the crude originals have been constructed as sailing vessels. This one, however, is intended to be driven by steam power, and is entirely different from anything ever before designed. It is the result of the theories of Mr. William T. Merritt, the owner, and the practical experience of Mr. George T. Polk, the builder. In some respects it is similar to an ordinary catamaran, the hull being in effect an ordinary hull split in two, the halves being placed about 15 feet apart, and the boarded perpendicular sides being exactly parallel to each other. These two half hulls are joined together by heavy beams. The width of the deck is 30 feet, and the length 70 feet. The hulls of Mr. Merritt's catamaran will be 51 feet on the keel, with only 7 feet beam, and 5 feet depth, so that while the deck is almost half as wide as it is long, the hulls are very long and narrow, will displace little water, and offer no more resistance than a single narrow hull. In each hull will be placed a 25 horse-power engine, operating two wheels, so that the vessel will have four wheels—two between and two outside of the hulls. The wheels themselves are of peculiar construction, being 8 feet in diameter, and of the kind known as the "feathering." The paddles are not fixed, but are movable, and by a simple latching and unlatching process are held at right angles to the water while plunging into it, and while coming out are edgewise; thus all the power is directly applied to forward propulsion, and none whatever is wasted in lifting or depressing the vessel. Other feathering wheels have been contrived, but none have yet proved of practical utility. The arrangement here used is the invention of Mr. Merritt himself, and its simplicity is expected to insure success. The name of the vessel has not yet been determined upon, but if she shows an astonishing speed, the marine wonder will be called the "Surprise." It has been thought that she may make 30 miles an hour.

The Discoverers of California.—It has been discovered from historical relics that the Chinese visited the coast of California in the fifth century, and our astute contemporary, the *Mining and Scientific Press*, published in San Francisco, remarks that this is the reason why the Chinese are now taking possession of California—by right of prior discovery.

Binns' Cord-Making Machine.

In a suburb of the great manufacturing town of Bradford, England, according to the London correspondent of the New York *Times*, is located the automatic mill of Mr. Binns, which we noticed on page 184 of our August number. It is indeed a wonderful machine, which will run night and day without any attendance or overseeing whatever, while many miles of silk cord, fringes, trimmings, and the like are tirelessly reeled off by the insensate, yet, it would seem, almost human worker. Moreover, if there be a breakage of the thread, even at the hour of midnight, in the deep darkness, when every hand of the mill is soundly asleep at home, and the building is entirely deserted, the comprehensive machine pauses, mends the break, and resumes its former progress as though no hindrance had occurred.

The main feature, and the foundation of this new mechanical discovery, is a circular jointless band or cord. The principle involved in it may be said to have been almost a life-work with Mr. Binns, who, self-made and self-educated, has acquired whatever knowledge he possesses from a long practical experience in the manufacturing business. His own words best tell the story of his persistent efforts: "I have been at this business —working out the endless-band principle—for thirty years. The idea first occurred to me when I was nine years old, at Queensborough, in Yorkshire, when I worked for Foster & Co., alpaca manufacturers. I was a spinner, and my experience as a boy of the trouble of the knots in the bands led me to think of one that should have no knot or joint. I got the master's permission to be employed in the designing room, where I did odd jobs for the designers, ran errands, and attended to little matters for them. At night, when I got home, I used to try and do what I had seen the designers do, sometimes working nearly all night, and after two years I showed what I could do. The masters and designers would not believe it was my work, but I soon convinced them."

Years later, when he had established a business of his own for the manufacture of fancy dress goods, "I began," he says, "to work out my youthful ideas, chiefly in regard to endless bands. It seemed to me, apart from the practical value of the spinning and other purposes, there was a trade to be done in window-cords, bell, and fancy ropes, and cord trimmings. The endless-band scheme accomplished, I set to work making an endless ornamental cord by a machine to run night and day unattended—a cord of every description and combination of color and design. My discovery, as one may say, was too great; I found that I could make in this one mill more cord than all the world could use. So I set about to deal with the surplus, applying it to ribbons, and other trimmings for ladies' dresses, jackets, paletots, mantles, nets, window curtains, and many other things. I have also been able to apply the machine to the manufacture of diamond yarns, both in silk and wool, to be made into all kinds of knitted, plaited, and woven fabrics, thus producing an entire novelty, which took the highest prizes at Paris for that class of exhibits."

In the principal apartment of the mill fifteen machines work quite unattended; they turn off silk and woolen cords of all kinds, and in many colors, combinations of silk and woolen, and in many varieties of design. Large bobbins, charged with material, and feeding themselves from endless rolls, revolve round each other upon a large rotating disk of slower movement. It is almost like an astronomical model of a sun, with a planetary system in motion. Between them travels yarn in course of working, and this is clothed in many hues and designs of revolving silk. The old method of manufacture was to make the cord in lengths longwise; Binns' principle is rotary and endless—almost without beginning and without end. Except for cleaning, it will work from Monday morning until Saturday night without being touched; it is self-feeding, self-taking up, and self-acting. It is difficult to describe the machine so as to realize it to the mind's eye of the reader, but, with the astronomical simile in your memory, first conceive a square bench, on that a flat revolving disk as large as a big Cammonbert cheese, and above that from six to a dozen revolving bobbins. The action of the machine appears to be so simple that one wonders at the inventor's temerity in showing it and allowing it to be described.

In a lower room of the mill a series of ordinary weaving machines work up in broad lengths for petticoats, trimmings, and other purposes, all kinds and sizes of the silken cords turned out in the apartment above; and in the warehouse adjoining large quantities of goods are packed for continental and other markets, such as fan-holders, made up of short lengths or remnants of cord, curtain-loops, silken necklets, bell-pulls, clothes-lines, dress trimmings, curtain borders, Berlin wool work in anti-macassars and other goods, endless spindle bands, endless window cord and sash lines. This mill has supplied Paris with large orders for goods at less than half the price of any other in the trade. In less than one day it is stated that as many as twenty-eight large cases of various ornamental and other goods have been made, packed, and sent by railroad.

The following vivid description of a visit at night to the automatic mill is given by a writer: "We went to the mill door. The business of the mill was going on as if hundreds of hands were employed. When the door was opened the darkness was pitchy—it could almost be felt; a sensation of awe succeeded to one of wonder—a mill at work by itself! One realized it because no sound of voices were heard; there were no girls singing at their work, no men calling to each other, no echoes of human voices; it seemed like an 'Arabian Night.' Presently a match was struck, and we climbed the wooden stairs by candle-light; another door was unlocked, and we were in the machine room. The din was deafening; every machine was at work. Here was a triumph of ingenuity; it was as if a modern realistic money-making Pygmalion had made a machine, and the spirit of science had breathed life into it. Under the glimmer of the candle-light we approached one of the machines; flash of wheel and bobbin, glitter of silken cord curling out like a variegated snake and falling in twining curves into collecting receptacles, met our wondering eyes, and it seemed as if the palpitating machine might have truly apostrophized us in the language of Tennyson's brook:

> 'For men may come and men may go,
> But I go on forever.'"

The Flooding of the Desert of Saharah.

We have on former occasions discussed the plan of flooding the Desert of Saharah, of which a large portion is lower than the surface of the ocean. The execution of this plan would open the African continent to European commerce, by admitting the waters of the Atlantic through an artificial channel into a vast depressed area of arid desert, which has for ages been the impassible barrier that has isolated the dwellers of the rich and fertile countries lying to the south from contact with civilization, and the subject has just received fresh impulse by its presentation in popular form in the pages of *Scribner's Monthly*.

The project of Mr. Mackenzie is older than that of M. Roudaire for creating an African inland sea, though by no means so well known as the latter; and if the engineering features of the scheme have been correctly stated and observed, the Mackenzie project could be made to accomplish vastly more important results, at a cost not greater, and probably considerably less, than that of Roudaire. What is known as the Basin of El Joof is a great depression, 200 feet below the ocean level, in the western portion of the Desert of Saharah, covering an area of 60,000 square miles, and was at one time an arm of the Atlantic ocean, the channel of which was placed not far from Cape Juby, opposite the Canary Islands. The mouth of this ancient channel, which is still discernible, is 2½ miles wide, and is blocked by a sand bar about 300 yards across, and elevated from 10 to 13 feet above sea level. Assuming these statements of the topography of the region to be accurate, as Mr. Mackenzie, after several explorations, affirms unequivocally, all that would be required to convert the arid basin of El Joof into a vast inland sea of 60,000 square miles in area, would be to pierce this ancient channel with a canal, 300 yards in length and a little over 30 feet deep. A small ditch only would be required for this purpose, Mr. Mackenzie claims, since, when communication was once established, the waters of the ocean would pour into the depressed basin and scour out the channel for itself.

The feasibility of this project on the score of engineering difficulties, says the *Engineering and Mining Journal*, does not appear ever to have been called into serious question; and of the two projects—Mackenzie's and that of Roudaire—for flooding the Algerian *chottes*, the former is not only vastly the greater in the possible geographical and climatic changes it would bring about, but in its commercial aspects also, since it would bring Timbuctoo, the great negro metropolis, within 2,000 miles of England, making it practically a seaport, and the whole of North Central Africa would be brought within easy reach of the harbors of Europe. Mr. Mackenzie has championed this scheme zealously and indefatigably for a number of years, and though he has suffered many checks and disappointments, his faith in its ultimate success appears to be unshaken.

We cannot forego repeating our former objection, that in that arid and excessively dry climate, where the evaporation must always largely exceed the rainfall, the evaporation of the water in the large inland sea would lower its level, and as there are no fresh rivers to supply the deficiency, it is to be supplied exclusively through the artificial channel with sea water, and this being salt, while the evaporation, carrying off only fresh water, the water must become more and more salt, and finally saturated. But it will not stop here: the salt will crystallize, and more salt water will enter, so that in the course of years the whole basin must necessarily become a gigantic salt deposit, as bad, and perhaps worse, than the present sand desert. In fact, it cannot well be otherwise, as the execution of the plan would be equivalent to the formation of huge salt works, operated by solar heat.

Our Salt Lake and the Dead Sea are two nearly saturated inland lakes, which have a constant supply of fresh water; it is the same with the ocean. But this inland sea of Saharah would have a salt water supply, and the results mentioned we believe would be unavoidable.

It is an interesting geological question, whether some of the large salt deposits, such as are found in England, Poland, and other countries, have not been formed in a similar way, by the existence of basins which were continually supplied with salt water, and heated by the solar radiation, or perhaps by the interior high temperature of the earth, or by both agencies, producing an evaporation more rapid than the rain-fall, and ending, of course, in a total elimination of the water, and the formation of a bed of rock salt.

The Decline in Prices.

As indicative of the remarkable general falling off in prices during the past decade, the following incident may be cited: A prominent drug and paint firm of this city, says the Boston *Commercial Bulletin*, were recently called upon to duplicate an order for white lead and linseed oil, filled in 1868, and upon examination of their old accounts, found that the charge for the former article was $14.25 per hundred, and for the latter $1.20 per gallon. To-day they are selling at $9.50 and 65 cents respectively. At the time above referred to, alcohol sold at $3 per gallon; to-day it is quoted at $2.02. Spirits of turpentine brought 75 cents per gallon; to-day it sells at 27½ cents. Naptha was held at 43 cents; to-day it is 7 cents. Other articles sold as follows: Sal soda at $3, oxalic acid at 35 cents, camphor at $1.10, brimstone at 4 cents, sulphur at 5¼ cents, and Venetian red at 3 cents.

Meteorology.

RECORDING THE DIRECTION OF THE WIND.

The direction or velocity of air currents is one of the most important studies in meteorology. The instrument used for recording their direction is simply a wind vane, but improved so as to answer this special purpose.

One of the best is that used in the meteorological observatories in France, and is represented in Fig. 1. It consists of two connected strips of thin copper of about 2 feet in length, fixed near the thinnest ends to a pivot A, and balanced by a counterpoise, which allows the whole to turn around with the greatest ease. Unlike the ordinary wind vanes, the supporting axis turns also. The copper strips are curved, so as to decrease their resistance to the wind, while the axis has four copper disks attached, seen at the lower part in a little box; this part is shown enlarged at the left-hand side in Fig. 1. These disks turn with the axis, and are marked N, S, E and W.

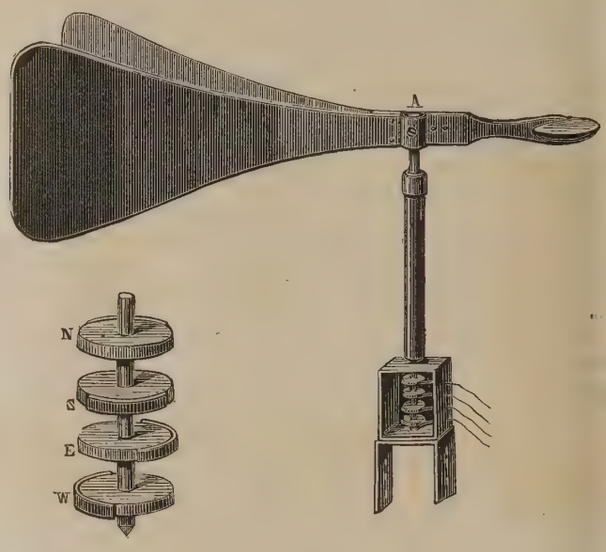


Fig. 1.

In order to report and register the direction of the wind by an automatic telegraph, each disk is cut out on its circumference, so that only a portion of its circumference can come in contact with a metallic spring, of which there is one for each disk. The projecting part is exactly a six-16th part of the circumference.

In order to understand the mechanism of the operation of this automatic telegraphic arrangement, we will first consider the disk Fig. 2, separately. It has on its surface the lines drawn found on the compass, North, East, South and West, with the four subdivisions of every wind. Thus the surface is divided by radii into 16 equal parts; of these six are on the projecting part, and contain the following names of wind directions: 1st. East Northeast to Northeast; 2d, Northeast to North Northeast; 3d, North Northeast to North; 4th, North to North Northwest; 5th, North Northwest to Northwest; 6th, Northwest to West Northwest. This disk, Fig. 2, turning with the pivot, can only make metallic contact when its projecting part is near the spring, when the current is closed by the wire corresponding with that disk. Fig. 1 shows all the four wires. The second disk (Fig. 3) contains on its six-16ths circumference the following winds: 1st, North Northwest to Northwest; 2d, Northwest to West Northwest; 3d, West Northwest to West; 4th, West to West Southwest; 5th, West Southwest to Southwest; 6th, Southwest to South Southwest; and the other disks are cut in a similar way.

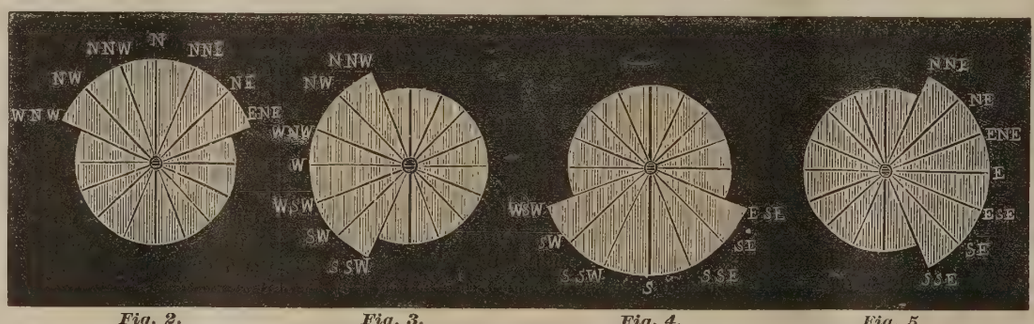


Fig. 2. *Fig. 3.* *Fig. 4.* *Fig. 5.*

These disks are attached one above the other, in exactly the positions indicated by Figs. 2, 3, 4 and 5, each of them interrupting the electric current when the cut-out portion of the rim is in front of its spring. The four electric wires attached to the four springs communicate with the office of the observer. When the position of any of the disks is such that a current passes, they charge an electro-magnet, which works a vibrating armature, the latter recording on a strip of paper passing over a cylinder, and regularly moved forward by clock-work.

There are in this way four equal arrangements, corresponding with the four disks and four winds—North, East, South and West. If the wind blows from the North, or between North Northeast and North Northwest, two-16ths of the circumference, disk Fig. 2 will be the only one that passes the current, and the vibrating armature connected with Fig. 2 only will be in operation. From North Northwest to West Northwest (the following two-16ths of the circumference), disk Fig. 3 will, as well as disk Fig. 2, close the circuit and operate its magnet and vibrating armature, so that both the North and the West armatures work, when it will be recorded that the wind blows between North Northwest and West Northwest. For the following two-16ths of the circumference disk Fig. 3 only makes contact and works its armature; for the next two-16ths this armature works, but also that of Fig. 4; for the next that of Fig. 4 works alone, and so on for the others.

The examination of the strips of paper on the four diagrams thus shows the variation of the wind for every moment of the day or night, and a permanent record is obtained of its direction near the earth's surface.

IMPENDING SCARCITY OF ANTHRACITE COAL.—The *Coal Trade Journal* publishes a statement giving the production of anthracite coal each year since the beginning of mining in 1820. According to the figures presented, the amount of anthracite marketed aggregates 307,000,000 tons; and if, the *Journal* says, the amount marketed represents but one-half of the contents of the seams worked, a moment's reflection will convince the most skeptical that the available supply may be exhausted before many decades. The amount mined in 1820 was 365 tons, or one ton for each day in the year. In 1878 the output was 17,605,262 tons. The greatest amount ever taken out in one year was 21,227,952 tons, while 1879 promises to produce 28,000,000 tons.

Our Duty in Regard to Memphis.

Last winter it was suggested in some quarters that one of the reasons why the United States should control the government of Cuba, was that Havana harbor was the pest-hole in which yellow fever was generated, as into it all the sewage was poured, and that it had only one outlet, and consequently no circulation. It was said that then the United States Survey could be charged with cutting a side outlet so that the tide could stream through the harbor, and thus the water, constantly renewed, kept clean and the cause of the fever removed, which yearly during the hot season is imported from there into the United States.

But those who broached that idea, forgot that the United States possesses a pest-hole in its midst, which is worse than Havana harbor. It is the city of Memphis, which is honey-combed with the sinks of privies, while a swamp lies adjacent where much of the refuse liquid from the city is kept stagnant. Last fall a gentleman of Chicago proposed to drain this swamp, which is now utterly unproductive and a nuisance, on condition that he should have the land reclaimed, in payment for the great expense to which the enterprise would subject him; but from the fear that a stranger would be benefitted by this, it was refused—at least no action was taken, and the swamp remains a nuisance, diffusing bad odors.

In regard to the privy vaults, we copy a report from a correspondent:

"With a fatuity which is entirely phenomenal, the work of emptying the privy vaults was carried on under a temperature marking from day to day 90° to 100°. It was not until after Judge Ray's death, on the 10th of July, that it seems to have occurred to any one in authority to order this disease-breeding business to be stopped. Comment has already been made upon the neglect of any sanitary precautions or work during the winter. It was not until May that any real cleaning up was undertaken, and when it begun, zeal rather than common sense seems to have inspired and directed every step. Repeated outbreaks of yellow fever in this country have been traced direct to the disturbance of decomposed organic matter in the late spring and early summer months. The merest tyro in sanitary science should have known, however, regardless of its specific application to yellow fever, the danger of the removal of the contents of these receptacles under the tropical sun of Memphis. It was bad enough to have these receptacles at all; in them, however, the pestilence only had limited means of dissemination; in the vaults it was doing the minimum amount of harm; it might, indeed, have been rendered entirely innocuous by filling them with clean, dry earth; but instead of any such measure, the work of emptying them was carried on until Yellow Jack, liberated from their horrid recesses, stalked forth into the midst of the now absolutely frantic community. Night after night the air was poisoned for blocks around; people were forced to vacate their premises, or to close doors and windows in the torrid, stifling atmosphere in the attempt to exclude the sickening effluvium. A few days before Judge Ray was taken sick, the vault of an adjoining house was cleaned, and many of the neighbors were taken sick with nausea and vomiting, and some were obliged to move to other parts of the city. The same condition of affairs prevailed throughout the entire city. The Tobin group of cases, nearly a mile and a half from Ray's, is attributed to the same cause, the air for several nights previous to July 10th having been heavily freighted with the stenches from the night carts at work in the immediate vicinity. There is hardly a square foot of soil in certain districts of Memphis not infected with yellow fever poison, which has hibernated from last fall. Wherever in the process of cleaning up, this has been exposed to the fervent rays of the summer sun, it

has been kindled into as much virulent activity as though freshly imported from Vera Cruz or Havana. It only needed the stagnant, superheated atmosphere which prevailed during those thirteen days to occasion the outbreaks which have already cost Memphis and the valley millions of dollars."

As the Memphis people have neglected their duty most shamefully, we hope that the United States government will take the matter in hand. It has the authority to defend the country against enemies; here is one more formidable than a foreign invasion—let it be crushed, *coute qui coute.*

The Pulsation of the Heart.

The method of giving graphic representations of motions and such vibrations as produce sounds, has been applied to record the beating of the heart and of the pulse. One of the forms of the instruments constructed for this purpose is called the Heart Myograph, and is represented in Fig. 1. It is adapted to make a graphic record of the pulsations of the heart of cold-blooded animals, such as frogs or turtles, which, as is well known, continue for quite a time after the heart has been separated from the body. The heart is fixed on some soft wax, so as to keep it in the required position upon a small disk attached to a stand; over the heart is placed a lever of light material, hinged in such a manner as to be easily movable in a vertical direction, while at the extreme end of this lever a fine pen traces a line on a revolving cylinder, seen at the left. Between the heart and the lever a small light rod of cork or elder-pith is placed resting on the ventricle of the heart, which, by its contractions and expansions, is periodically moved up and down, and thus communicates its motions to the lever. The end of the lever will then describe a line on the revolving cylinder, which is more or less vertical, in proportion as the contraction of the heart is more or less sudden. This contraction is, in medical language, called the "systole," while the relaxation is called the "diastole." During the systole the blood is expelled from the ventricles of the heart through the arteries, and during the diastole or relaxation it is admitted from the veins through the auricles, which it enters first. These alternate movements, causing a periodical action of the lever, will be traced by its point in a curve, and it is clear that the motion of the pulse, the contraction of a muscles, or any other similar operation, may be recorded in this way.

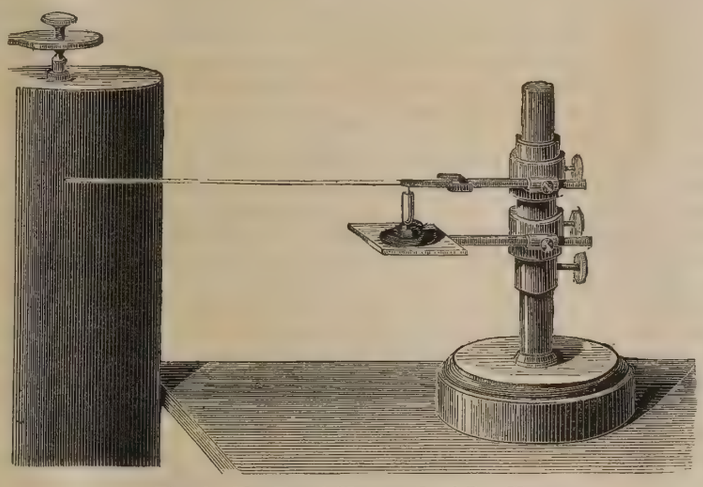


Fig. 1.—The Heart Myograph of Dr. Marey.

The simple act of the periodical beating of the heart is only an element of the more complex phenomenon offered by the contraction of the other muscles by the operation of the will. In these voluntary contractions a series of successive shocks succeed each other with such rapidity, as to fuse together as it were, and to cause an apparently steady contraction, in the same way as the nerve of a muscle may be excited and the muscles contracted by a succession of very rapid interrupted electric currents; the quicker the currents succeed one another the more gradual are the contractions, and inversely, when the currents are so intermittent as to give perceptible intervals, the muscular contractions become intermittent. These currents may be so divided in regard to time as to correspond, for instance, with the rhythm of the heart, and then a succession of pulsations will be obtained, perfectly uniform with those of the heart, and which may be recorded in the same way. That contraction of the heart called systole is not a simple act, but one of the elements of a more complicated series of contractions, which have been recorded in the manner referred to.

It was an interesting physiological question to ascertain whether the quantity of blood thrown into the arterial trunks increased in proportion to the frequency of the pulsations. In order to settle this, Prof. Marey used the heart of a turtle, attached the aorta to a tube and the vena cava to another tube, tying the other orifices; the heart, thus provided with artificial supply and exhaust tubes, was suspended in a small stoppered flask, through the cork of which the tubes passed. The venous tube, acting as a suction siphon, was plunged into bullock's blood, which had been deprived of fibrin by beating with a broom-corn twig, and furnished the heart with oxygenized blood, which kept up its motions, while the arterial tube discharged the blood projected by the heart.

In measuring the volume of the blood projected during a given number of pulsations, the amount corresponding to each pulsation was easily ascertained, and it was found that when the pulsations are more rapid the amount ejected by each is less, which might be expected, as by the too rapid motion the heart has not time to relax sufficiently to allow the blood to fill it to its full capacity.

In order to find the work done by the heart in a given time, it is necessary to measure the resistance it can overcome; but as it was impossible to measure the manometric value of the pressure of the blood in the arteries which the heart has to overcome for every pulsation, the following arrangement was contrived:

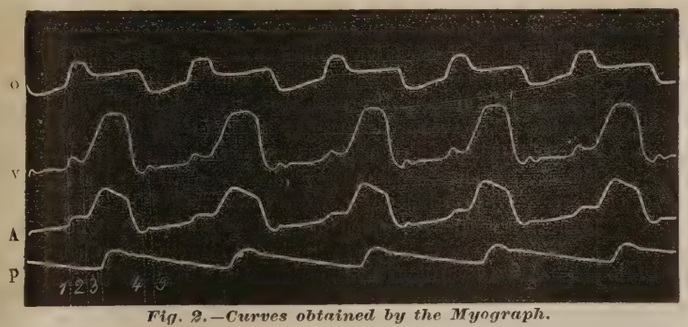


Fig. 2.—Curves obtained by the Myograph.

The heart was made to act under variable conditions by raising or depressing the outlet, while the myograph was applied to various parts of the same, to the aorta, to the vena cava, and especially to an elastic outlet made in the closed vessel containing it, and in which the air was alternately compressed and dilated, when the heart was alternately relaxed and contracted.

The spygmograph is an instrument, which, applied to the pulse, traces curved lines on a slip of paper systematically moving forward. A series of curves of various natures was obtained by the myograph, which we reproduce in Fig. 2, and are records of the nature of the motions of various parts of the beating heart.

In Fig. 2 the upper line O contains the curves obtained by the arrangement seen in Fig. 1, when the small light rod, before described, is placed on the auricle of the heart; the line V shows the curves obtained by the contractions of the ventricle, A the same of the aorta, while P represents the pulse, the point producing the curves moving from left to right. In comparing the two lower lines, it will be seen that in the aorta various small waves are produced, which disappear at a distance from the heart by the elasticity of the arteries; still a small tremulous motion remains, as may be seen near the figure 4; between 3 and 4 the maximum fullness of the artery is seen in the maximum elevation, while after a sudden decrease of pressure and a tremulous movement, the pressure decreases so gradually as to form an inclined plane, (see figure 5); this goes on as marked at 1 and 2; when at 3 the systole of the ventricle suddenly expands the aorta, and with it all its ramifications—that is, all the arteries. It will be seen, as might be expected, that the line V traced by the ventricle has the greatest elevations, that of the aorta A less, and least of all the line P, representing the pulses over all the body.

We ought to add here that in 1870, long before the practical application of the telephone, we attended an evening lecture given by a physician of Salem, Mass., before the members of the American Association for the Advancement of Science, in which he made the pulsations of the hearts of patients in the hospital in Boston, perfectly audible to an audience of several hundred persons, showing distinctly the difference in sound between a healthy heart, a diseased heart, or the hearts of patients suffering from typhus or other fevers.

A 1,500 Horse-Power Hoister.—The new hoisting machinery for the Yellow Jacket shaft, now being constructed in San Francisco, will be surpassed by nothing of the kind on the Comstock. It will be a double cylinder, direct-acting hoist; each engine will have a stroke of 8 feet, cylinders 28 inches in diameter, and will be of a non-condensing character. They are to work at a steam pressure of 120 pounds to the square inch, and at 50 revolutions per minute will have a piston speed of 800 feet, while hoisting from a depth of 4,000 feet each will exert 1,500 horse-power. A flat steel rope, 7 inches wide, ½ inch thick, and 4,000 feet long, will be used in hoisting. The Union shaft is now supplied with hoisting works, and will soon be furnished with pumping machinery superior to any now in use on the Comstock. The new pumping engine will be of the compound condensing style, the initial cylinder being 64 inches in diameter, with a stroke of 7 feet. The expansion cylinder is 100 inches in diameter and 8 feet stroke. It will have 8 strokes per minute and 136 feet of piston speed in the same time, and will exert about 1,500 horse-power. It will operate a double line of 14-inch pumps, having a stroke of 10 feet.

Carrier-Cats vs. Carrier-Pigeons.—It is well known that if a cat is carried a distance from its home it will find its way back in a short time, even when carried off in a bag and turned loose at night. This wonderful instinct in travelling through unfamiliar regions has suggested the possibility of cats being used as special messengers. Recently thirty-seven cats residing in the city of Liege, Belgium, were taken in bags a long distance into the country. The animals were liberated at 2 o'clock in the afternoon, and at 6.48 the same afternoon one of them reached its home. His feline companions arrived at Liege somewhat later, but within twenty-four hours every one had reached its home. It is proposed to establish a regular system of cat communication between Liege and the neighboring villages, and thus use cats as a substitute for carrier-pigeons.

Scientific.

CHEAP ILLUMINATION.—The New York *Sun*, under the title "Cheap Illumination," contains an article on carburetters and gas machines, in which it is stated that an application, recently made for an important patent, will discount the stock of the platinum mine for which Edison is searching.

This is an underhand thrust at Edison's recent appeal to miners to give attention to platinum if found in their neighborhood. As his experiments induced him to believe that the best material for electric lamps would be incandescent platinum wire, he wished to reduce its price, which is at present too high for general introduction for the manufacture of lamp tips, and he attempts to reduce the price by encouraging the supply. The success of this appeal is very improbable; platinum will no doubt be found in new localities, but the steadily increased demand for this highly useful material will we believe keep the price up.

The account given in the article referred to in regard to the patents applied for, is really amusing, and this for the simple reason that it consists, first, of the description of a Canadian invention said to have been bought and improved by Edward A. C. Pew, of Welland, Ontario. It consists in passing ordinary street gas through a cylinder containing a porous material saturated with gasolin, so as to enrich the gas with carbon and increase its light-giving qualities. This account is followed by the ordinary statements, how the gas was improved and the amount economized, for the benefit of those using it.

Now, almost every one knows that these carburetters were introduced some twenty-five years ago, and that so many different forms have been patented, and the patents run out, that it is very doubtful whether any more patents will be granted, as at present it lacks one of the first and principal requisites of patentable inventions—namely, novelty.

It is further stated that: "Mr. Pew associated with him Mr. Jacob Weart, a well-known lawyer of excellent standing in Jersey City, who has also brought his ingenuity to bear on it. In the course of his experiments Mr. Pew discovered that atmospheric air forced through the carburetter, and thus charged with the hydrocarbon evolved by the gasolin, would burn equally as well as gas, whose agency could thus be dispensed with altogether. He consequently substituted for the gas pressure an air pump with India rubber valves, whereby the air is pumped through an India rubber reservoir into the carburetter. Ordinary clock-work furnishes the motive power. When the gas jets attached are opened, and the air begins to flow through them, the air pump starts; when the gas jets are turned off the reservoir fills with air, and the pump stops. The whole movement is automatic."

We should like to know what difference there is between the principle of this arrangement and that of the various gas machines now extensively used, and some of them patented as long ago as 15 years—such as the Maxim gas machine, and others. Many of these are driven by a wound-up weight, which, by its descent, drives a bellows, pump, or gas holder, and thus produces a current of air, which, flowing through carburetters filled with gasolin, benzole, turpentine, or their equivalents, charges the air with their vapors and makes it combustible. Many self-regulating devices have been added, intended to stop the pumps when the gas is not being used; so that such automatic arrangements are now quite old, and it is really surprising to see how otherwise intelligent people may be ignorant not only of the novel practical inventions which have been going on around them, but are almost daily advertised and offered for sale on Broadway and other business streets. Such has been the case with these very gas machines.

In looking over our notes relating to inventions of this kind, we find (besides a plan of our own, made in 1867, but which we did not prosecute, as we found it to have been anticipated by others) the following data:

1st. O. P. Drake patented, May, 1862, a machine operated by a weight, to be wound up once a day. It consisted of a blower forcing air through a carburetter containing gasolin. The machines were made by the Ferris & Co. Automatic Gas Apparatus Company, of Wilmington, Del.

2d. Hurd, Warren & Swift, in May, 1865, patented a machine, worked by weights, which blew air through gasolin. The patent was bought by the American Portable Gas-Light Co., and was introduced in 1866.

3d. The Springfield Gas Machine Co., with all their patents, was bought by Gilbert & Barker in 1869, with the right to make machines constructed on this very same principle.

4th. The Union Self-Acting Gas Machine Co., the same thing, with a slight modification. Manufactory, Boston; office, 14 Dey street, New York.

5th. Rand took out four or more patents in February and December, 1867, and in February and April, 1869, for an apparatus to blow air through petroleum or gasolin. The office was at 16 Nassau street, New York.

6th. The Columbia Gas-Light Co., of Columbia, S. C., office at 708 Broadway, New York, patented by Richard Palmer, of Columbia, S. C., in November, 1870.

7th. Kidd took out a patent in 1871, for enriching gas with air blown by a steam jet through gasolin vapor.

8th. The Eagle gas machine, patented 1871; manufactory, 37 Railroad avenue, Newark, N. J.; office, 14 Dey street, New York, Same arrangement of air blown over gasolin.

These machines were in such extensive use in 1869, that a committee was appointed by the New York fire insurance underwriters to investigate and report. Their report on these very gas machines and carburetters was adopted and published; it contained several stipulations to be observed by the makers of the machines, but so severe as to be equivalent to a prohibition of most of the above described arrangements, and this justly, as they are actually very unsafe.

We will now quote another paragraph, to show how old inventions are often heralded as novelties. The report in the *Sun* proceeds thus:

"To this Mr. Weart has added another invention, adapting this principle to the more extensive uses of large establishments. To the Pew carburetter he has attached a blower such as is ordinarily used with steam engines. With one man turning a crank connected with band wheels air is forced through the blower into a small diaphragm air chamber, which allows the superfluous air to escape. Through the air chamber the air passes into the carburetter, a cylinder of about the size and shape of an ordinary water cooler, and thence into the gas pipes. With these appliances he produces seventeen jets of light. Mr. Weart claims that his invention is peculiarly adapted to lighting railway trains. A demonstration of this was witnessed at his residence on Jersey City Hights by Superintendent McCrea of the New York division of the Pennsylvania Railroad, and several other gentlemen. Mr. Weart pointed out that the Westinghouse brake attachment would furnish all the necessary power to pump in the requisite air for lighting a railway train, and that one carburetter placed in a baggage car would suffice. Speaking of the comparative cost of the new illuminator, he said: 'With gasolin at 14 cents a gallon, and allowing 1 cent a gallon for the expense of charging the carburetter, and burning lights equal to those from the 6-foot burners in ordinary use, the saving will be about 54 per cent in New York, where gas is sold at $2 per 1,000 feet, and about 60 per cent in Brooklyn and Jersey City, where it is $2.75. With the increased use of gasolin there is likely to be more of it made, and the cost may thereby be further reduced; the price has already fallen to 13 cents, and at 10 cents a gallon we could furnish lights 75 per cent cheaper than the average price of gas.'"

To this we feel obliged to remark that there was a time several years ago when gasolin was almost worthless, because no use had been found for it. Thus, at Cozzens' petroleum distillery at Greenpoint, L. I., it was gradually discharged into a swamp and burned up, there being no demand for the large quantities obtained. Since the invention of gasolin machines a demand has been created; it is now also used for other purposes, such as a substitute for ether for refrigerating in ice-making machines, as a solvent for paraffin and other substances, to make rhigolin and chymogen, to wash gloves, extract oils, fats, etc., and the prices of gasolin and benzin have gone up, even above that of kerosene, so that there is no longer any fear that kerosene will be adulterated with more volatile and dangerous substances, because this does not pay now.

The price of gasolin varies according to the grade, the lighter grades costing more, according to their greater volatility and lower boiling point. Mr. Pratt, of the Standard Oil Company, who works under a patent granted to the editor of this journal in 1870, furnishes gasolin at prices varying from 20 cents to $1 and more per gallon, according to specific gravity, which for the highest price ranges as low as 0.6, being the lightest grade of all fluids known, and boils at a temperature of 16° below the freezing point of water.

We mention this as a warning to those who, deluded by false representations, would be inclined to rush into the expense of erecting gasolin gas works, and also to show the value of the closing sentence of Mr. Weart's remarks as published in the *Sun*. He says: "I see that Mr. Edison estimates that he can produce seven electric lights to the horse-power. With this gasolin arrangement we can produce one hundred lights with one-eighth of a horse-power. I can see no reason to doubt that the problem of cheap light is solved."

To all of this must be added the important fact that gasolin is a substance of so highly inflammable a nature, that no fire insurance company can be found willing to insure a concern where it is used, much less where such quantities are kept on hand as are necessary to supply the gas machines described. Most railroad companies, ships, and steamers even refuse to transport this material, as we ourselves have found to our loss and annoyance.

THE END OF THE WORLD.—Camille Flammarion, the well-known French scientist, thus beautifully expresses himself in *La Correspondance Scientifique*, regarding the ultimate fate of our globe:

"We all of us admire to-day the beauties of terrestrial nature, the verdant hills, the perfumed meadows, the purling brooks, the mysterious shades, the groves animate with singing birds, the mountains crowned with glaciers, the immensity of the seas, the warm settings of the sun in clouds edged with scarlet and gold, and the sublime glimmering of the sun on the mountain tops when the first rays of the morning shiver in the gray mists of the plain. We admire the human works which to-day crown those of nature; the bold viaducts thrown from one mountain to another, and over which speeds steam; the ships, marvelous structures traversing the ocean; the brilliant and animated cities; the palaces and temples; the libraries, museums of the mind; the arts of sculpture and painting, which idealize the real; the musical inspirations which make us forget the vulgarity of things; the works of the intellectual genius who explores the mysteries of the world and transports us into infinity; and we live in happiness in the midst of this life so radiant, making ourselves an integral part of it. But all this beauty, all these flowers and these fruits will pass away. The earth was born; she will die. She will die either of old age, when her vital elements shall have been used up, or through the extinction of the sun, to whose rays her life is suspended. She might also die by accident, through collision with some celestial body meeting her on her route; but this end of the world is the most improbable of all.

"She may, we repeat, die a natural death through the slow absorption of her vital elements. In fact, it is probable that the air and water are diminishing. The ocean, like the atmosphere, appears to have been formerly much more considerable than it is in our day.

The terrestrial crust is penetrated by waters which combine chemically with the rocks. It is almost certain that the temperature of the interior of the globe reaches that of boiling water at a depth of about six miles, and prevents the water from descending any lower; but the absorption will continue with the cooling of the globe. The oxygen, nitrogen, and carbonic acid which compose our atmosphere, also appear to undergo absorption, but slower. The thinker may foresee, through the mist of ages to come, the epoch, yet afar off, in which the earth, deprived of the atmospheric aqueous vapor which protects her from the glacial cold of space by preserving the solar rays around her, will become chilled in the sleep of death. As Henri Vivarez says: 'From the summit of the mountains a winding sheet of snow will descend upon the high plateaus and the valleys, driving before it life and civilization, and masking for ever the cities and nations that it meets on its passage.' Life and human activity will press insensibly toward the intertropical zone. St. Petersburg, Berlin, London, Paris, Vienna, Constantinople, and Rome will fall asleep in succession under their eternal shroud. During very many ages equatorial humanity will in vain undertake arctic expeditions to find again under the ice the place of Paris, Lyons, Bordeaux, and Marseilles. The sea coasts will have changed, and the geographical map of the earth will have been transformed. No one will live and breathe any more except in the equatorial zone up to the day when the last family, nearly dead with cold and hunger, will sit on the shore of the last sea, in the rays of the sun which will thereafter shine here below on an ambulent tomb revolving aimlessly around a useless light and a barren heat."

New Theories in Regard to the Origin and Use of Petroleum.—While in Russia the use of petroleum is being discouraged, attempt are being made in Pennsylvania to prevent its further production. The papers report that two months ago an individual was circulating a petition to be presented to the Legislature of that State to prohibit the sinking of any more wells, because the oil is needed to lubricate the axis of the earth, which is already beginning to grind by the abstraction of the oil provided for that purpose. A good many signatures have been obtained, the ignorant imagining that they are going to save this whole earth from utter destruction, which must necessarily follow when the natural lubricating material provided by Providence for this heavy piece of machinery is recklessly abstracted by selfish oil companies, who would risk the destruction of all creation if they can only make money.

In Russia the orthodox priests are teaching the farmers that after Satan had rebelled against heaven, and was vanquished by the heavenly host, he was imprisoned beneath the mountain range of Caucasus, and condemned to rot there. The result of this decomposition of the devil is—petroleum, which therefore is an infernal fluid, as evident from its nauseous odor and dangerously inflammable qualities. The consequence of this teaching has been that the farmers of the district of Poltava, where this doctrine is being taught, have unanimously abolished the use of kerosene lamps.

So there appears to be still room for the diffusion of more enlightened doctrines.

Is the Telephone an Instrument of the Future?—Prof. W. H. Preece, an eminent English electrician, said lately in public, that he did not think that the telephone would be an instrument of the future and be largely adopted by the public. "For," said he, "although it has been adopted to a great extent in America, we have not the same necessity for it, as we have an abundance of messengers for all purposes, which the Americans have not."

And we Americans thank Heaven that we have not that abundance of intelligent men who can find nothing better to do than to serve as messengers for all purposes, and that therefore we need telephones, have them, and use them extensively. While England has only 500 in use, we use 50,000 of them, and therefore we think with Prof. Preece, that the telephone is, even among us, not an instrument of the *future*, but that it is an instrument of the *present*.

Has Edison Really Accomplished Anything?

The New York *Sun* contains the following communication, which we republish:

"In a communication addressed to the *Sun* last fall, about the time that Mr. Edison was promising to have Menlo Park lighted up, in six weeks or thereabouts, with his new electric light, claiming that he 'had it all right,' and all that it needed was the completion of 'a few minor details,' the writer hazarded the statement that holders of gas stock would be very foolish to value their stock any less on account of the absurd and unscientific claims made for the new light by Edison and his friends.

"The belief thus expressed having been undisturbed by the developments of nearly a twelve-month in the laboratory of the 'great inventor,' it may not be presuming too much if the writer should venture another opinion or two on the subject.

"Edison has said over and over during the year past that he had solved the problem of the 'indefinite subdivision of electric light.' Far from this being true, he has not even approximated the solution, and he will not solve it, at the rate of his progress thus far, in a century. Nothing that has been announced so far, as coming either directly or indirectly from Edison or his coadjutors, indicates any real advance beyond the published reports of the accomplishments of foreign and home inventors. True, he has originated or devised one or two deviations from old forms of apparatus that may perhaps be called Edisonian, but take his present apparatus as a whole and hold it up alongside of the claims made for it, and one cannot but see the justice of the criticism made by the celebrated French electrician, M. Fontaine, of Paris, one of the highest authorities living. This savant said, in substance, after reading Edison's recent patents or apparatus for electric light, that they indicated a very slight knowledge of the subject, and if Edison had not had the merit of inventing the phonograph, his present inventions (described in these patents) would not deserve any attention, but would be passed by as childish and inferior.

"Mr. Edison has been lately announcing that he was solving the problem of an improved generator, and had got it all right. An inspection of the machine itself shows it to be merely a slight modification of the Siemens machine, the first one in the field, and in no respect its superior. When will the public cease to believe a thing just because Edison says it is so? Those who know him most intimately cannot understand it. Other inventors besides Edison have been pursuing the phantom of indefinite subdivision, but with little better success than the 'Professor of Duplicity and Quadruplicity.' Claims have been advanced without number, but performance has not followed.

"The writer has, after the most careful inquiry, ascertained that the very best result yet achieved in electric lighting, either here or abroad, is the production of from 18 to 20 lights of 1,500 to 2,000 candle power each, from one machine, with voltaic arc lamps, in series on one circuit, with an absorption of 14 horse-power. This is claimed for the Brush apparatus by the Riverside Mill of Providence, R. I., where 48 Brush lights are in use. Now, notwithstanding this result, if true, shows a production of light per horse-power nearly 25 times as great as Edison's latest claim of being able to produce 7 small lights from one horse-power, the writer still repeats his caution of last fall to owners of gas stock: 'Don't sell out for nothing just yet.' Let us see what the promoters of the Brush machine say in their printed circular: 'Electric light is not adapted to the illumination of dwellings, offices, small stores, etc., or for any place where 10 or 15 gas burners or oil lamps now suffice, but only for large rooms or spaces where considerable light is needed.'

"Until some system of lighting by electricity is perfected which will enable a man to light up one or all of his rooms, a storekeeper his small store, a lawyer or physician his office, a hotel-keeper every room in his hotel at once, or only one at a time—as cheaply, as conveniently, and as certainly as it is now done with gas or oil—no holder of gas stock need fear that his dividends will stop or materially diminish. It is much more likely that, as electric light finds its way into the limited sphere in which it is fitted to shine, the advantages of using plenty of light which it will surely develop, will stimulate the bulk of every gas company's customers—the small consumers—to use more light.

"This brings me to my final prediction, which is, that if gas companies are wise they can make more money this year than last, and so on. I have not a dollar's interest, directly or indirectly, in gas or gas stocks, but will take all that any one wants to give away."

Preventive of Sea-Sickness.

Various remedies against sea-sickness have been recommended, but being a purely nervous affection, caused by a derangement of the nervous equilibrium from the unaccustomed motion of the body and the sight of other such motions of the surroundings, there is no one remedy that will help everybody, as the condition of the nervous system in different individuals is as various as the form of their faces, as every experienced physician knows. Therefore it is well to know the different remedies that have been successful, so as to be able to adopt another treatment when one is found to fail.

We have often found that the recommendation to eat very moderately, and to remain on the deck of the vessel as much as possible, may postpone sea-sickness for some days, and if the voyage is of short duration the passenger may escape; but if the trip is of long duration sickness is sure to take place the first rough day, and then the remedies here named may be tried.

Dr. Lœderich, a French physician, highly recommends the treatment of sea-sickness with collodion. This has been the means of warding it off from many who were predisposed to suffer from it, and had suffered much before. The collodion is applied with a brush in three successive layers on the epigastric region (over the stomach) and the neighboring parts. It acts in such cases in the same way as in peritonitis, for which it is a powerful anti-emetic.

The *Algerian Journal of Medicine* reports another way of treating sea-sickness. M. Velasco advises injections of 0.005 of a grain and 0.02 of a grain of morphine, and says he has experienced its good effects on himself and his family.

The Boston *Journal of Chemistry* recommends bromid of potassium. This should be taken in 20-grain doses, two or three times a day, and it has worked well in the cases of some persons very sensitive to sea-sickness. Tourists will find it convenient to take with them to sea a solution of the bromid, prepared of such a strength that a teaspoonful will contain 20 grains of the salt. This quantity can be taken in a third or half a tumbler of water. The *Journal* states that this remedy has never been known to fail, but acknowledges that it might fail in very desperate cases. One should begin taking it before being exposed, and should, if possible, get well under its influence before the time of trial comes. In many cases smaller doses would probably answer the purpose—they can be graduated according to the person's susceptibility to the influence of the bromid.

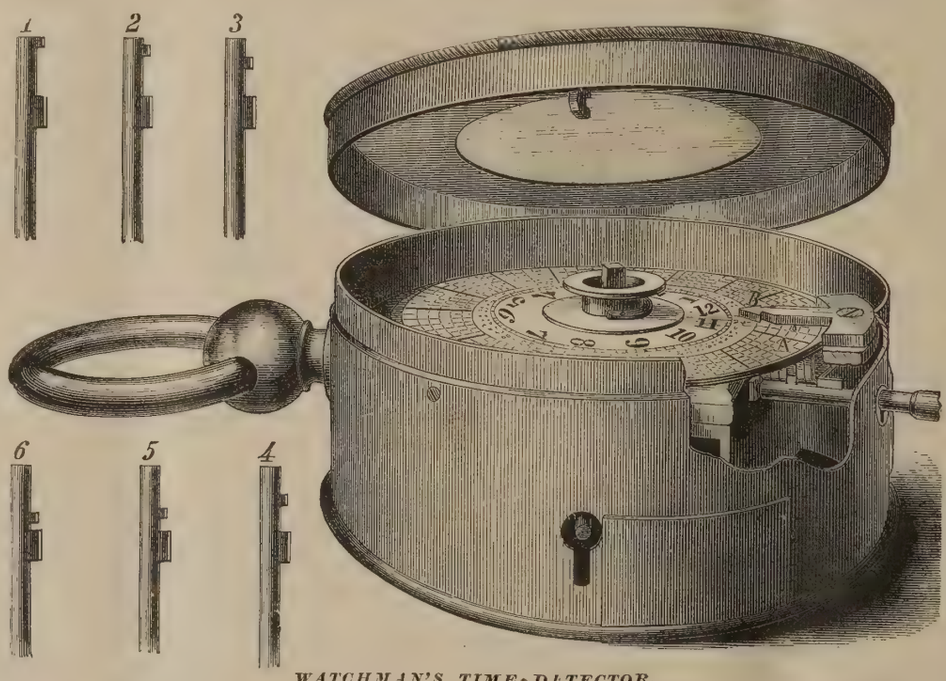
We will add to this that we have known cases of nausea and vomiting to result from the use of bromid of potassium, and whether those constitutions that become sea-sick from it while on terra-firma, will be cured by it from sea-sickness when on the ocean, is an interesting question; but this fact makes us doubt the efficacy of this drug in a great number of cases.

Watchmen's Time Detectors.

The watchmen employed by large manufacturing companies, or others who have much value at stake, have often under their charge an enormous amount of property of various kinds, which is in fact, as it were, at their mercy; and if a watchman neglects his duty, the result may not only be a loss by fire to the owners, but the deprivation of the daily bread earned by the hundreds of persons employed.

The Chinese system, similar in other cases, is to employ a second watchman to watch the first, and often a third to watch the second, and so on. The example for this is given by the Chinese government, which maintains an extensive and expensive system of mutual espionage; something of this kind is practiced here, but it is almost daily going out of use, thanks to ingenious contrivances and regulations, which make this system of espionage in most cases obsolete.

One of the most successful contrivances of this kind is Buerk's watchman's time detector, represented in the adjoined engraving, and which has been secured by several patents. It is carried by the watchman like a timepiece, while the keys intended to mark the time when they have been used, are securely fastened at the various stations he has to visit at regular hours, which precaution prevents him from carrying the keys with him. His duty is to go from station to station, take the key fastened there, insert it into the lock, give it one turn, and go on to the next, or to any other station, for he is not bound to go in regular order. From this it follows that a perfect record will be kept of each operation.



WATCHMAN'S TIME-DETECTOR.

The broken-out portion of the watch shows the mechanism which operates the pin that pricks the paper. At A there are a number of sliding bars which connect with the pricking points, so that, by turning the key, the ward on it strikes a certain bar, and penetrates the dial paper B. By that act a small hole is made in the paper, which tells what time the man appeared at each station, how often he came there, how long he stopped, how long it took him to go from one to another, whether he went in regular order or not—in short, it gives a complete record of his night's work.

The small keys, 1 to 6, are samples of different keys. A flange on the side of the key prevents it from being turned unless it is inserted quite into its place, so that the key used for one station cannot be used to make the mark for a key at another, nor, indeed, can any key, except a perfect duplicate, be made to do it. Any attempt on the part of the watchman to evade his duty by counterfeiting keys may be effectually baffled by occasionally changing keys from one station to another. An indefinite number of stations can be served.

The watch is wound, set, and closed every day by the proprietor or superintendent, and the box locked with a key which he keeps, so that the register within is unseen by and out of reach of the watchman who carries it. In the morning, when the detector is returned to the superintendent, the graduated disk of paper may be removed from its position and filed away as a permanent record, while a new disk is applied for succeeding records.

We are informed that the success of this time detector has induced infringements of Mr. Buerk's patent, which have been prosecuted and decided in his favor. So much as a warning to sellers, buyers and users of the imitation article, which in no case costs less than the original, the price of which, complete with 12 keys and 400 dials, is $75. This includes a recent improvement, consisting of a lock placed in the cover, which gives room for a three-lever lock that cannot be picked; an arrangement of levers that cannot get out of order or be broken, to take the place of the recording springs previously used; a stationary barrel, which prevents damage to the wheels or pinions in case the mainspring breaks; a brass cap, covering the entire movement, and excluding dust and dirt.

The value of these detectors in planing and saw mills and box factories, where the liability to fire is so great, is especially evident, and that a vast amount of property has been saved by their use, there can be no doubt. An instance showing where their absence has resulted very disastrously, is the recent burning of a large planing mill in Brooklyn, N. Y., where the watchman on duty fell asleep, and before he awoke the entire building was in flames. Had the time detector been employed in this case, the watchman would have been compelled to remain awake, so as to make his periodical tours around the building, and a destructive fire would doubtless have been prevented.

Further information in regard to these detectors can be obtained by addressing the manufacturer, J. E. Buerk, 230 Washington street, Boston, Mass., P. O. Box 979.

Chlorate of Potash from the Dead Sea.

Chemical analysis having long ago shown that the waters of the Dead Sea in Palestine are rich in chlorate of potash, a company has been formed, and already commenced operations, to extract this salt from its waters. It is stated that in this way chlorate of potash can be obtained 30 per cent cheaper than by the cheapest process thus far known; and as there is an increasing demand for this salt, it is a safe and profitble investment. In order to save fuel, which is scarce in those regions, the works are kept in the most active operation during the dry season, when the water is low and the river Jordan does not dilute them much, the water level varying considerably, and consequently the concentration. This body of water, of course, contains the soluble ingredients from the hights surrounding the whole water-shed, of which the rains have made a lye, and solar evaporation has concentrated in that sea.

IMITATION SILK.—Considerable excitement has been caused in Lyons, France, by a discovery which purports to give to flax all the qualities and appearance of silk. It has long been known that silk is soluble, not only in powerful acids, but also in soda and chlorid of zinc; and it is said that these qualities are made use of in the new process. A company is being formed, with a capital of $6,000,000, for the manufacture of the new textile.

The Government Works at Hell Gate.

As a valuable addition to what we have heretofore published respecting the improvements at Hell Gate, now in progress, we are enabled to give an extract from the official report of Capt. James Mercur, who has the most important part of these works in charge. Our readers will remember that Hallett's Point had been extensively tunnelled under the bottom of the river, so that a single colossal blast could disjoint thousands of tons of rock, which it did most successfully. Capt. Mercur says that at Hallett's Point he has removed 19,706 gross tons of sunken rock, at a cost of $2.29 per ton. This was done by the Atlantic Dredging Company under a contract. Their contract ceased on May 1, and advantage was taken of the absence of their machinery to make an examination of the reef by means of a survey. The shallowest point found was 14 feet below mean low water, while over that part of the reef to which the dredging had been applied, the depths varied from 21 to 28 feet, the required depth of 26 feet having been obtained over a large part of the reef. The total amount of rock removed since the final blast is 5,702 tons, leaving about 2,000 tons to be removed.

With reference to Flood Rock, to which we referred on page 174 of our August number, Capt. Mercur says that the water which filled the mine stopped the work for some time, but after a while a drill was started. The broken rock taken out of the mine up to June 7, 1879, was used for building an island large enough to give place for machinery, etc., for carrying on the work. The total number of cubic feet put on this island is approximately 5,722, and its area above low water is 2,600 square yards. In addition to the work done on the mine, permanent arrangements have been made for carrying on the work. The head frame and cages for hoisting are nearly completed; the island has been arranged so as to afford facilities for unloading all supplies; and there remains to be completed a wharf on the east side of the island for stone scows to lay at while receiving their loads, and the necessary chutes and pockets for passing the stone from the cars to the scows, self-dumping cages and necessary mine cars, together with the purchase of a powerful tug and two dumping scows for removing the broken rock. With these facilities it is proposed to increase the present rate of working about four times, or more, if the amounts appropriated from year to year justify it.

REFINING OIL IN PHILADELPHIA.—The completion of the Tidewater Pipe line is expected to create refining works on a large scale in Philadelphia. At Greenwich Point, works were completed, only a couple of months since, capable of refining 2,000 barrels of crude oil monthly, and it is stated that arrangements have also been made by which the capacity of the works is to be doubled. Within the last few days a project has been started to build a refinery capable of refining 1,000 barrels per day, which is to be built at Gibson's Point.

Latest Market Report of Building Materials.

NEW YORK PRICES.

ARTICLES MARKED WITH A STAR (*) ARE QUOTED IN GOLD.

—o—

LUMBER.

Pine, very choice and extra dry, per M	$55 00 a 60 00
Pine, good	45 00 a 50 00
Pine, shipping box	18 00 a 22 00
Pine, common box	16 00 a 17 00
Pine, common box, ⅝	13 00 a 15 00
Pine, tally plank, 1¼, 10 inch, dressed, each	40 a 43
Pine, tally plank, 1¼, 2d quality	35 a 38
Pine, tally plank, 1¼, culls	25 a 28
Pine, tally boards, dressed, good	28 a 30
Pine, tally boards, dressed, common	22 a 25
Pine, tally boards, culls, dressed	21 a 23
Pine, strip boards, merchantable	16 a 18
Pine, strip boards, clear	22 a 25
Pine, strip plank, dressed, clear	33 a 35
Spruce boards, dressed	18 a 20
Spruce plank, 1¼-inch, dressed	22 a 25
Spruce plank, 2-inch,	28 a 34
Spruce wall strips	13 a — 15
Spruce timber, per M	16 00 a 19 00
Hemlock boards, each	14 a — 16
Hemlock joist, 2½x4	15 a — 16
Hemlock joist, 3x4	16 a — 18
Hemlock joist, 4x6	40 a — 44
Ash, good, per M	30 00 a 50 00
Oak	32 50 a 65 00
Maple culls	20 00 a 25 00
Maple good	45 00 a 85 50
Chestnut	42 00 a 48 00
Cypress, 1, 1½, 2, and 2½-inch	35 00 a 40 00
Black walnut, good to choice	85 00 a100 00
Black walnut, ⅝-inch	75 00 a 85 00
Black walnut, selected and seasoned	110 00 a150 00
Black walnut counters, per ft	12½ a 20
Cherry, wide, per M	85 00 a100 00
Cherry, ordinary	60 00 a 80 00
White wood, chair plank	60 00 a 70 00
White wood, inch	25 00 a 45 00
White wood, ⅝-inch	30 00 a 45 00
White wood, ⅝ panels	35 00 a 50 00
Shingles, extra sawed pine, 18-inch	5 00 a 7 00
Shingles, clear sawed pine, 18-inch	4 00 a 5 00
Shingles, cypress, 24x7	20 00 a 22 00
Shingles, cypress, 20x6	12 00 a 15 00
Lath, Cargo rate	1 40 a — —
Yellow dressed pine flooring	25 00 a 35 00
Yellow pine girders	30 00 a 40 00
Locust posts, 8 feet, per inch	18 a 20
Locust posts, 10 feet	24 a 25
Locust posts, 12 feet	29 a 34
Chestnut posts, per ft	3 a 3½
Basswood per M	25 00 a 30 00

Cargo rates, 10 per cent off.

BRICKS.

	Cargo.	Afloat.
Pale, per M.	3 50 a	4 00
Jersey	5 75 a	6 00
Up Rivers	6 00 a	6 50
Haverstraw Bay	6 25 a	6 50
" " choice	6 62 a	6 75
Favorite Brands	8 00 a	— —
Hollow Fire-Clay Brick	9 00 a	9 25

FRONTS.

Croton—Brown, per M.	7 50 a 8 50
" Dark	8 50 a 9 50
" Red	9 00 a 9 50
Philadelphia	26 00 a 28 00
Trenton	24 00 a 29 00
Baltimore	34 00 a 38 00

Yard prices 50 cents per M higher, or with delivery added $2 per M for hard and $3 per M for front brick. For delivery add $5 on Philadelphia and Trenton, and $6 on Baltimore brick.

IRON—PER TON.

Duty.—Bar, 1 to 1½c. per lb.; Railroad, 70c. per 100 lbs.; Boiler and Plate, 1½c. per lb.; Sheet, Band, Hoop and Scroll, 1¼ to 1¾c. per lb.; Pig, $7 per ton; Polished Sheet, 3c. per lb.; Galvanized, 2½c. per lb.; Scrap Cast, $6 per ton; Scrap Wrought, $8 per ton—all less 10 per cent. No Bar Iron to pay a less duty than 35 per cent ad val.

Pig, Scotch—Coltness	20 50 a 23 00
" Glengarnock	21 50 a 22 50
" Eglinton	21 00 a 23 00
" American, No. 1	21 00 a 23 00
" American, No. 2	19 00 a 20 00
" American, forge	18 00 a 19 00

	Store prices.	Cash.
Bar, Swedes, ordinary sizes	— 5 a	— 6
Bar, Swedes, nail-rod	— — a	— 6½

LEAD—PER 100 POUNDS.

*German	— — a — —
*English, common	— — a — —
*Spanish	— — a — —
*Foreign, refined	— — a — —
*Bar	5 00 a — —
*Sheet and Pipe	5 00 a 6 00
*Domestic	3 37 a — —

NAILS—PER KEG.

10d to 60d, common, fence and sheathing	2 30 a — —
8d and 9d, common	2 85 a — —
6d and 7d, common	3 10 a — —
4d and 5d, common	3 35 a — —
3d and 4d, light	4 10 a — —
3d, fine	4 85 a — —
2d, fine	4 85 a — —
Cut spikes, all sizes	2 85 a — —
Clinch nails, 1½ to 1¾ inch	5 00 a 5 25
do. 2 to 2¼ inch	4 75 a — —
do. 2⅛ to 2¾ inch	4 50 a — —
do. 3 inch and longer	4 25 a — —

TIN PLATES.—Duty, 1 1-10 cents per pound.

*I. C. charcoal, 10x14, per box	6 25 a 6 50
*I. C. coke, 10x14	5 00 a 5 75
*I. X. charcoal, 10x14	8 25 a 8 50
*I. C. charcoal, 14x20	6 25 a 6 50
*I. X. charcoal, 14x20	8 25 a 8 50
*I. C. coke, 14x20	5 00 a 5 75
*I. C. coke, terne, 14x20	5 00 a 5 25
*I. C. charcoal, terne, 14x20	5 50 a 6 00

ZINC.—Duty, sheet, per lb., 2½ cents.

Sheet, (cask) per lb	— 6⅞ a — 7
Sheet, (open)	— 7½ a — —

SOLDERS.

No. 1	— 9½ a — 10
No. 2	— 9 a — —

STONE.—Cargo Rates.

Amherst Freestone, in rough, per cubic foot	— — a — 85
Berlin Freestone, in rough	— — a — 95
Berea Freestone, in rough	— — a — 75
Brown-Stone, Portland, Conn	1 25 a 1 50
Brown Stone, Belleville, N. J	1 00 a 1 50
Granite, rough	— 60 a 1 25
Canaan Marble	1 25 a 1 50
Dorchester, N.B., Stone, rough, per foot	— — a 1 00

PAINTS.

*Carmine, American, per lb. gold	5 50 a 5 75
Chalk, per lb.	— 00¼ a — 00⅜
China Clay, per ton gold	20 00 a 22 00
Chrome yellow, dry, per pound	— 12½ a — 28
Lead, red American, per pound	— 7 a — 8
Lead, white American, pure, in oil	— 7 a — 8½
Lead, white American, pure, dry	— 6¾ a — 7¼
Lead, white English, pure, in oil gold	— 9½ a — 10½
Litharge	— 7 a — 8
*Ochre, Fr., dry, per 100 lbs	1 50 a — —
Ochre, ground, in oil, per lb	— 6 a — 15
Ochre, Vermont, per 100 lbs	— 75 a 1 00
*Orange Mineral, English gold	— 9½ a — 10
Paris White, American	— 1¾ a — 1½
Paris White, English, prime	— 1¾ a — 2
Paris Green	— 15 a — 28
Plumbago paint, patent, per lb	— — a — 25
Putty, per lb	— 1¾ a — 2½
Spanish Brown, dry, per lb	— 1⅛ a — 1¼
Spanish Brown, ground in oil, per lb	— 8 a — 9
Venetian red, per cwt	1 75 a 2 00
*Vermilion, Chinese, per lb	— 80 a — 90
*Vermilion, Trieste	— 70 a — 80
*Vermilion, quicksilver, bags gold	— 55 a — 57½
Vermilion, American, common	— 15 a — 18
Whiting, per 100 lbs	— 50 a — 80
Zinc, white American, dry, No. 1	— 5 a — 7½
Zinc, white American, No. 1, in oil	— 8 a — 10
*Zinc, white French, dry, (Red Seal) gold	— 8 a — 8¼
Zinc, white French, in oil gold	— 10 a — 10½

VARNISHES—PER GALLON.

American Wearing Body	3 50 a 4 00
Coach Body	2 35 a 3 50
do do	1 80 a 2 00
Furniture	1 25 a 2 50
Black Asphaltum	1 00 a 1 50
Brown Japan	1 00 a 1 20
Liquid Paint Dryer	1 35 a 1 75
Harness, (black)	3 00 a 4 50
Shellac, Spirits	3 00 a 3 50

CEMENT—PER BARREL.

Portland (imported)	2 75 a 3 50
Portland (American)	2 50 a 2 75
Roman	2 75 a 3 25
Keene's, coarse	6 50 a — —
" fine	10 50 a — —
Martin's, coarse	6 00 a — —
" fine	10 50 a — —
Rosendale	— 90 a 1 00

DEADENING AND ROOFING MATERIAL.

Mineral Wool for Roofs and Deadening, per lb. — 1¼ a — 1½

HAIR.

Cattle, per bushel of 7 lbs	— 9 a — 12½
Goat, " "	— 15 a — —

SLATE.

Purple roofing slate, per square	$6 00 a 7 00
Green slate	6 00 a 7 00
Red slate	10 00 a 11 00
Black slate, Pennsylvania, (at Jersey City)	5 00 a 5 25
" " Cargo rate	3 25 a 3 75
Slate tiles, 1¼-inch, rubbed, per square foot	20 a — 25

PLASTER PARIS.

Duty.—20 per cent ad. val. on calcined; lump free.

Nova Scotia, white, per ton	2 90 a 3 00
Nova Scotia, blue	2 80 a 2 85
Calcined, Eastern and city, per bbl	1 00 a 1 15
Calcined, city casting	1 20 a 1 25
Calcined, city superfine	1 30 a 1 50

LIME—PER BARREL.

State, common	— 75 a — —
" finishing	— 85 a — —
Rockland, common, cargo rate	— 60 a — 65
" finishing	— 80 a — 85
Ground	— 65 a — 70

Add 25 cents to above figures for yard rates.

FOREIGN WOODS.

MAHOGANY.

St. Domingo, crotches, ordinary to good, per ft	— 15 a — 20
St. Domingo, crotches, fine	— 20 a — 30
St. Domingo, logs, small	— 5 a — 8
St. Domingo, logs, large	— 20 a — 30
Frontera, Mexican, large	— 11½ a — 16
Frontera, Mexican, small	— 8 a — 10
Other Mexican	— 8 a — 14
Honduras	— 10 a — 15

ROSEWOOD.

Rio Janeiro, ordinary to good, per lb	— 2½ a — 8
Rio Janeiro, good to fine	— 5 a — 8
Bahia, ordinary to good	— 2 a — 6½
Bahia, good to fine	— 4½ a — 8
Honduras, per ton	10 00 a 20 00
Satin Wood, per foot	— 15 a — 60
Tulipwood, per lb	— 6 a — 12½
Lignumvitæ, small, per ton	10 00 a 20 00
Lignumvitæ, large	25 00 a 50 00

CEDAR.

Cuba, per superficial foot	— 12½ a — 16½
Mexican, small	— 8 a — 10
Mexican, large	— 10 a — 16
Florida	— 50 a 2 00

DOORS, WINDOWS, AND BLINDS.

DOORS, RAISED PANELS, TWO SIDES.

2.0 x 6.0	1¼ inch.	$ 67	—
2.6 x 6.6	1¼	— 95	—
2.6 x 6.8	1¼	— 99	—
2.8 x 6.8	1¼	1 04	—

DOORS, MOLDED.

Size.	1¼ inches.	1½ inches.	1¾ inches.
2.0 x 6.0	$1 23	—	—
2.6 x 6.6	1 52	1 93	—
2.6 x 6.8	1 57	1 85	—
2.6 x 6.10	1 59	2 01	—
2.6 x 7.0	1 62	2 09	—
2.8 x 6.8	1 62	2 09	2 57
2.8 x 7.0	1 69	3 17	2 69
2.10 x 6.10	1 79	2 26	2 84
3.0 x 7.0	1 87	2 45	3 00

INSIDE BLINDS.

Per lineal foot, 4 folds, pine	04 a — —
Per lineal foot, 4 folds, ash or chestnut	— 07 a — —
Per lineal foot, 4 folds, cherry or butternut	— 08 a — —
Per lineal foot, 4 folds, black walnut	— 10 a — —

OUTSIDE BLINDS.

Up to 2.10 wide, per lineal foot	— a —
Up to 3.1 wide	— a —
Up to 3.4 wide	— a —
Do. painted and trimmed	40 a —

WINDOW FRAMES.

Up to 3.4 x 7.2, put together 2 30 a — —

DRAIN AND SEWER PIPE.

(Delivered on board at New York.)

Discount 50 to 60 per cent, according to quality and size of order.

PIPE, per running foot.

2 inches diameter,	$0 13	10 inches diameter,	$0 70
3 "	0 16	12 "	0 80
4 "	0 20	15 "	1 25
5 "	0 25	18 "	1 60
6 "	0 30	20 "	2 00
7 "	0 35	22 "	2 50
8 "	0 45	24 "	3 00
9 "	0 55		

GENERAL REVIEW OF THE MARKETS.—The tone of the markets has slightly improved during the month, and dealers generally have been doing a very fair business, with prices in most cases well sustained. The outlook for the fall months is encouraging, and while predictions have not been very fruitful in fulfillment lately, there is no doubt that material is now on the upward turn, and unless some extraordinary circumstance occurs, the indications are that this healthy improvement will continue. Building shows no diminution in activity, as evidenced by the great number of new buildings in course of erection in the up-town portions of the city.

THE MARKETS IN DETAIL.—In the lumber market trade has preserved a healthy undertone, and while in some cases dealers have expressed dissatisfaction at the state of business, the general feeling has been one of contentment. Building operations as planned will be full, and the general manufacturing interest is likely to prove a good source of consumption this season. Values have been firm, and we retain former figures on most articles.

In the brick market common hards have found rather a slow sale, and the feeling has been weak and unsettled. Since our former report was written a sort of brick famine has prevailed, and in many cases builders found it impossible to proceed with their work, owing to the absence of supplies. The market did not, however, long remain in this condition, and there is at present a large accumulation of stock on hand, so great indeed that manufacturers propose stopping shipments for ten days, or a couple of weeks, and thus if possible to reduce the pressure of stock seeking sale. Prices are somewhat uncertain, but have shaded again a fraction on actual sales.

In the lime market, on Eastern stock, trade has preserved a pretty steady and cheerful tone, and full former rates have been maintained without much difficulty.

In the lath market no great change has taken place since our last. Demand has been pretty fair.

In the hardware market business has not only been very good in a general way, but many of our dealers are driven to execute their orders. The South and Southwest have bought pretty freely, and the West has been well represented.

In the paint market there has been a growing and more general demand, with the tone of business improving, especially in a jobbing way.

In the metal markets Scotch pig has met with a much better sale, and this, together with higher rates abroad, imparted a firmer tone and established some advance. American pig has also been finding a good demand, and there has been a steady hardening on values. Manufactured iron has been firm and meeting with a good, steady call. Domestic pig lead has found rather a slow demand. Pig tin has met with a good, steady demand, apparently for early consumption, and values have been well maintained. Tin plates have sold with much freedom, and the market has been firm. Zinc has been on the upward turn, with a good current demand.

Cements, Mastics, and Concretes.

Many of our readers have occasion to use cements or mastics, especially in putting down cellar floors or making old walls tight. They will find the following hints upon the subject valuable:

A cement of one part sand, two parts ashes and three parts clay, mixed with oil, makes a very hard and durable substance like stone, and is said to resist the weather almost as well as marble.

Damp brick walls are common, especially in houses in the country where they are exposed upon the north and east sides. So common is this, that in many places in the country a strong prejudice exists against brick houses on account of their constant dampness. Last year a gentleman having a brick house exposed on all sides, and suffering from dampness in the kitchen, which was in a wing upon the most exposed side, tried an experiment which has proved very satisfactory. A barrel of the best English Portland cement was purchased, and a common tin wash-basin used for mixing it. The cement was mixed with water until about the consistency of cream, and then applied thickly with a large paint brush. Of course the mixture had to be constantly stirred to prevent the cement from settling to the bottom; and on account of its very rapid settling it could only be mixed in very small quantities—half a gallon being about as large a quantity as can be readily handled at a time. When first dried it seemed somewhat of a failure, because it could be so easily brushed off, but after it had had 24 hours to harden it formed a strong and durable coating. The color is a neutral tint, something like Ohio stone. This coating kept the wall perfectly dry, and as it is inexpensive and does not require skilled labor in its application, ought to be extensively used. The gentleman who put on the cement suggests that a damp, foggy, or misty day is best for its application. The coating should be brushed into all the crevices and openings of the work, and it may be found desirable to apply two coats in order that all the openings may be completely closed.

Cement is much stronger than mortar, and can be used to great advantage in many places instead of lime, even in the face of the fact that it is much more costly than the latter. The usual proportions are 1 part of hydraulic lime to 5 of sand. In pointing, the proportion is sometimes as low as 3 parts sand to 1 of hydraulic lime or cement. Coarse clean sand—almost pebbles—can be used to the extent of 3 parts to 1 of cement. Some recommend mortar, to be allowed to set and then wet and worked again. This course will not answer with cement, which is generally injured by such a method of working. The greatest enemy of both mortar and cement is frost; the power with which water expands at the freezing point is practically unlimited, and where it penetrates into the crevices and pores of mortar and freezes, or when wet mortar is allowed to freeze, its strength is destroyed.

For making floors, the following method is said to produce very desirable results: Four parts of coarse gravel or broken stone and sand, and one part each of lime and cement, are mixed in a shallow box, and well shoveled over from end to end. The sand, gravel and cement are mixed together dry; the lime is slacked separately and mixed with just enough mortar to cement it well together. Six or eight inches of the mixture is then put on the bottom, and when well set, another coating is put on, consisting of one part of cement and two of sand. This will answer for making the bottom of a cistern that is to be cemented up directly upon the ground without a lining of bricks; it will also form a very good cellar floor.

Edge-Laid Belts.

According to Leigh, a better method of producing a broad belt than the usual American double leather belting sewed together—a method by which the article can be made with the greatest ease, of any thickness or width, perfectly equal in texture throughout, and alike on both sides—consists in cutting up the hides into strips the width of the intended thickness of the belt, and setting them on edge, these strips to have holes punched in them about ⅛ of an inch in diameter and 1 inch apart; nails, made of round wire, clinched up at one end for a head and flattened at the other, are used for fastening the leather strips together. Each nail is in this case half the width of the intended belt, and after the strips are all built upon the nails, the ends of the latter are turned down and driven into the leather, thus making a firm strap, without any kind of cement, splicings, or similar treatment. When a strap made in accordance with this plan requires to be tightened, it is only necessary to take it asunder at the step lines of the splice, cut off from each end of the strap what is required, and piece up again with wire nails or laces, going entirely through the strap.

Sanitary Inspection of New York Tenements.

Sometime ago the Board of Health appointed inspectors to visit the tenement houses in this city, and these have been making very careful examinations; when the inspections are finished they will be able to present a detailed report covering every tenement house in New York. There are, it is estimated, twenty-five thousand of these. The examination has already gone far enough to indicate that while a few of them, comparatively, are in such condition as the law requires, in many of them the laws are constantly violated, while not a few present sickening proofs of the most wanton violations on the part of the landlords, not only of all sanitary regulations, but also of the most ordinary requirements of decency. The most scrupulous examination is being made into the ventilation, sewerage, closet and water facilities of each house. Careful inquiries are also being made regarding the number of people in every tenement.

In the 17th Ward, which has been the first visited by the inspectors, it appears that a vast number of tenements have been built in complete violation of the sanitary laws of the city. Many of them are old buildings that have been altered over into tenements without the least regard for the sanitary regulations of the city. The principal evils already noted by the inspectors are those that pertain to ventilation, light, sewerage and overcrowding. It already appears that many of the tenements, especially in East Third, Fourth and contiguous streets, and in the Tompkins Square region, are greatly overcrowded. Some of the tenements in that section contain on their five floors a population of from thirty to forty adults, and from forty to fifty children. Many of these are occupied by people who conduct their daily business in them, such as cigar-making and tailoring. Hundreds of tenements, some of them belonging to the Astor estate, have been discovered, where families of five, six, seven and ten are crowded into two and three rooms. The reports of dark and entirely unventilated sleeping rooms are very many. In many of these tenements the sleeping rooms are between the front and rear rooms, with absolutely no ventilation excepting such as comes by the doors, and are dark at all times, day and night. Many of the tenements are reported as lighted only by skylights, while there are frequent complaints of intolerable smells and noxious odors. In East Third street, near the Catholic church, tenements are in very great demand, and thus far inspection shows that in the greater number of them are found many violations of sanitary ordinances, the most complaint being of imperfect ventilation. Further up, in East Twelve and Thirteenth streets, the inspectors found many tenements, densely populated, the yards adjoining which were used for stables, and from which the most noxious stenches arose. In the rear of a tenement on Second avenue an old graveyard was discovered, the sewerage in the vicinity being wholly inadequate. Hundreds of tenements are reported in this and other regions of the Seventeenth Ward, where no light whatever is admitted to the sleeping rooms; and there are many reports of tenements of four stories containing six families, where the sewerage is imperfect, the water tepid and bad, the sleeping rooms foul, small and dark. The inspectors have found many basements and cellars that are occupied by families, which are damp and unwholesome. Thus far the most general complaint, even in regard to tenements that are otherwise exceptionally clean, is of the lighting and ventilating of sleeping apartments by skylights alone, and of insufficient plumbing arrangements in water closets.

This work will go on, probably, for three months. It is believed by that time a detailed account of every tenement in the city can be presented to the Board of Health, and that steps can be taken to compel the landlords to comply with the sanitary laws. Some of the inspectors are reported to have said that they did not understand how some tenements in the Seventeenth Ward had escaped being deadly plague spots already, for in them every law of health, so far as cleanliness and pure air are concerned, is daily violated.

New Uses for Petroleum.

As vigilant and anxious a search is being prosecuted for new uses for petroleum as ever was made in days of old for the philosopher's stone. Two new fields of usefulness are reported to have already been found for this material. One of these is the manufacture of soap, and it is reported that some chemists from Marseilles, France, have patented a process in England by which they claim to have succeeded in producing a paraffin or benzin soap. They add melted animal fatty matter, such as stearin, to the mineral oil in the proportion of about 15 parts of stearin to 100 parts of the oil. This is then thoroughly mixed by stirring and the mixture boiled with the alkali in the usual manner. They state that either hard or soft soap can thus be made, according to whether soda or potash is used, and assert that soaps thus made have special cleansing and disinfecting qualities.

If the progress of manufacturing science has really succeeded in producing a superior soap from the products of petroleum, that can be made as cheaply as from competing ingredients, a vast quantity of petroleum might be used in that way, as the world requires a great deal of washing—more, in fact, than it ever gets. There is some belief, however, that the thing won't wash.

The other new sphere of usefulness for the superabundant products of the oil wells, has additional claims upon public attention, inasmuch as it is said to be included in a discovery by which a superior quality of refined iron can be produced from common scrap iron. Either crude or refined oil may be employed, and the process by which the iron is made, is known as the "oil-fuel process." Prof. Henry Wurtz, of Hoboken, N. J., who is one of the highest metallurgical authorities in the United States, has analyzed a sample of this "petroleum iron," in comparison with the "Benizon" brand of iron produced in Boston, and pronounces it fully the equal of the latter. The results obtained were tabulated as follows:

	Benizon Iron.	Petroleum Iron.
Iron	98.247	98.140
Manganese	.929	1.206
Carbon	.150	.129
Silicon	.198	.175
Phosphorus	.120	.094
Sulphur	.041	.031
Slag	.315	.225
	100.000	100.000

LIFE-SAVING APPLIANCE.—The New York *Herald* recommends the construction of the globular life-boat which we described and illustrated two years ago, (see page 185 of our August number for 1877). It is suggested that the various steamship lines crossing the Atlantic should have them on board—one for every 50 passengers. We are in favor of giving this invention a fair trial, and are surprised that it has not already been tested.

Home Department.

The Universal Bath.

The Universal bath, represented in the adjoined engraving, is a valuable appliance that can be attached to the common house chair. It weighs but 15 pounds, is simple, strong and durable, yet marvelously adjustable; it is of material similar to the body of a diving-bell, which is well known to be proof against fresh, salt, and all kinds of mineral waters, and being vulcanized by steam, it is applicable to vapor baths also, while from the pliable and peculiar nature of its rubber and cloth texture, a single one is efficient for almost every conceivable form, size and kind of bath—vapor and water, infant, adult, full, sitz, spine, sponge, electric, mineral spring, artificial sea baths, etc. Applications which would corrode and ruin a metallic bath, do not injure this in the least, therefore in a bath-room it is far superior to any metallic bath, and it is stated by those who have used it for many years, that it requires so little water, is so light, easy to manage and stow away, that it renders a bath-room unnecessary. It is never immovably fastened, but may be set up in any room, hence it may be taken to the bedside of the sick, and used in almost any desirable form or style. When not in use it is collapsed and hung up like a common garment.

This bath was originally designed for ordinary family use only, but the many conveniences and important advantages which it presents have attracted the attention of eminent physicians, who recommend it for convenient use in practice. Its conveniences for bathing are even better than they are in bath-tubs that cost say $160, and are obtained by its simplicity in structure at a cost of about one-10th this sum.

Illustrated circulars, with testimonials can be obtained by addressing E. J. Knowlton, Ann Arbor, Mich.

THE UNIVERSAL BATH.

Kissing Pets a Cause of Sore Throat.—A writer in the *British Medical Journal*, in a communication to the editor in regard to the possible cause of the recent outbreak of an epidemic of sore throat at Darmstadt, says: "It is well known that women and children are in the habit of kissing pet cats and dogs, especially when these favorites are ill with discharges from the nose, cough, and sore throat, and even use their pocket handkerchief to wipe away the secretion. I have seen this done frequently. As such mistaken sympathy is exceedingly dangerous, I think a statement to this effect would tend to discourage this practice. It is a common saying: 'There! the cat has got a cold; now it will go through the house;' and as this remark has been repeatedly verified, it shows how careful people should be to avoid contact with such a mode of contagion. I do not affirm that this was the way in which the disease was contracted, either within or without the palace walls, but I feel sure that the habit of kissing pets is a source of danger that should be widely known and prevented."

Neglect of the Eyes.

Dr. E. G. Loring publishes in *Harper's Monthly* for August, an article on the eyesight, from which we extract the following useful advice, as it deserves to be widely diffused:

"Whatever an ounce of prevention may be to other members of the body, it certainly is worth many pounds of cure to the eye. Like a chronometer watch, this delicate organ will stand any amount of use, not to say abuse, but when once thrown off its balance, it very rarely can be brought back to its original perfection of action, or, if it is, it becomes ever after liable to a return of disability of function or the seat of actual disease. One would have supposed from this fact, and from the fact that modern civilization has imposed upon the eye an ever-increasing amount of strain, both as to the actual quantity of work done and the constantly increasing brilliancy and duration of the illumination under which it is performed, that the greatest pains would have been exercised in maintaining the organ in a condition of health, and the greatest care and solicitude used in its treatment when diseased. And yet it is safe to say that there is no organ in the body the welfare of which is so persistently neglected as the eye.

"I have known fond and doting mothers take their children of four and five years of age to have their first teeth filled, instead of having them extracted, so that the jaw might not suffer in its due development, and become in later years contracted, while the eye, the most intellectual, the most apprehensive, and the most discriminating of all our organs, receives not even a passing thought, much less an examination. It never seems to occur to the parents that the principal agent in a child's education is the eye; that through it it gains not only its sense of the methods and ways of existence of others, but even the means for the maintenance of its own; nor does it occur to the parents for an instant that many of the mental as well as bodily attributes of a growing child are fashioned, even if they are not created, by the condition of the eye alone.

"A child is put to school without the slightest inquiry on the part of the parent, and much less on the part of the teacher, whether it has the normal amount of sight; whether it sees objects sharply and well defined, or indistinctly and distorted; whether it be near-sighted or far-sighted; whether it sees with one or two eyes; or, finally, if it does see clearly and distinctly, whether it is not using a quantity of nervous force sufficient after a time not only to exhaust the energy of the visual organ, but of the nervous system at large."

Sunlight and Health.

Sunlight is even more necessary to health in summer than in winter; for one, among other reasons, that disinfectants of all sorts are more necessary in summer than in winter. The rays of heat quicken the vital powers, the chemical rays exert their mysterious and potent influence, and the illuminating rays, independently of the others, communicate motion. The exhalations from our bodies in warm weather are more copious than they are in cold weather, and if we shut out the light from our houses we remove the most efficient of all agents in destroying what is unwholesome. The noxious vapors, which free admission of air and light would remove, are absorbed by carpets and upholstery, and become productive of disease. Those who are accustomed to the darkness and dampness of close rooms may not consciously suffer therefrom, but that they sustain real injury is evident in their pallid faces, their flaccid muscles, and their nerveless movements. The contrast between them and those whose lives are passed in the open air is too evident to need comment. It may not be necessary to expose during the day every room in the house to the direct rays of the sun, but there should be frequent opening of doors and windows, so that the solar rays may perform their beneficent office. Bedrooms, and other rooms in constant use, should receive most careful attention in this respect; sick rooms especially require thorough sunning and ventilation, and, if possible, should always have a southern aspect. More patients die on the north side of hospitals than on the south side; there are more deaths on the shady side of any street than on the sunny side. A notable Southern housekeeper, observing strictly the following rule during the summer months, kept her house perfectly sweet, cool and dry from May to October: Until ten o'clock in the morning, all the doors and windows were opened wide; then they were closed until four in the afternoon, and then opened again until nightfall. This rule might not do for all localities, but such a use of it as should secure a free access of light and air to every part of the house at least once a day would be productive of good results.

Finger Nails.

Hardly any personal peculiarity is more noticeable or more indicative of character than the finger nails. There are some who believe that palmistry, or the reading of character from the hand, can be reduced to a science just as much as phrenology. If so, it would necessarily be an obscure science to the majority of people; but the signs of character indicated by the finger nails may be read by all with a little study.

In the first place, the shape of the nail is very significant. The slender, tapering nail, of a rose-pink hue, with a shell-like, transparent edge, is always the accompaniment of a refined nature; broad, stubby nails, of a yellowish-white color, and with opaque, muddy-looking edges, indicate natural coarseness, though they often accompany great good nature, while the other variety as frequently goes with a sharp, shrewish temper.

The care of the nails is one of the most revealing marks of personal habits, and one of the most important of the minor operations of the toilet. Nails may be greatly improved, both in shape and color, by proper attention. The best appliance is a nail brush, used in water softened by the addition of a little borax and really fine toilet soap. In well brushed and well cared for nails the little curtain-like rim which surrounds them is well pushed or rolled back, displaying generally a delicate little crescent at the root. The skin of the finger should never be allowed to grow upon the nail. In paring and trimming, the shape given should always be as long and oval as possible; to cut a nail square off gives the finger end a stubby look. The corners should be carefully and closely cut, and the center left rather long, so as to give the long oval shape. In cleaning the nails the knife should never scrape off the inner substance of the nail, as this renders the edge opaque and muddy in appearance, whereas it should be transparent. The nail is susceptible of a high degree of polish by rubbing with the towel when drying the hands.

The habit of biting the nails is one against which children should be carefully guarded; it is ruinous to the very structure of the nail, and once acquired is one of the most difficult habits to break. This is evidenced by the fact that some men and women, but more especially men, have a habit of biting their nails when reading or studying, of which they are perfectly unconscious. Many lawyers and clergymen occur to mind whose nails are almost a deformity from this habit.

Miscellaneous and Advertising.

Send to the Valley Machine Co., Easthampton, Mass., for catalogue and price-list of their celebrated pumps.

The English Factories Act requires that no woman shall be employed continuously for more than four hours and a half. After working that length of time she must have a rest.

A firm of Sheffield cutlers, the chief portion of whose trade is with America, are reported to be about to abandon their works at that place, and to emigrate to the United States, taking with them about 100 Sheffield workmen and a large number of Germans.

It is stated that Alvin Clark & Son, of Cambridge, Mass., have been intrusted with the work of grinding and finishing the object glass for the great telescope, for which the Russian government has appropriated 250,000 roubles—about $215,000.

E. A. Goddard, of 176 Fulton street, New York, agent for the American Twist Drill Co.'s emery-grinders, has, besides a large number of styles of these machines, an extensive line of machinists' supplies, and will be pleased to send his catalogue and price-list to any address on application.

Henry Steeger, of 143 and 145 East Thirty-first street, New York, has one of the largest and most complete establishments in the country for the manufacture of plumbing goods and cooking utensils, and the steady expansion of his business has been due solely to the high standard he has always maintained both in the workmanship and material that have been employed in the production of his manufactures.

But two extensive plate glass manufactories exist in this country—one at New Albany, Ind., and the other at Lenox, Mass. This probably arises from the fact that men of limited means are debarred from embarking in this branch of the business, owing to the large capital required—over a million dollars being necessary to fit up a factory with appliances suitable for the purpose, and each of the houses named has from three to four millions invested.

The Peerless Brick Company, of 208 South Seventh street, Philadelphia, produce now with their brick machines, 200 kinds of brick of various architectural shapes and colors, and are prepared to furnish the same at reasonable prices. The vast superiority of these bricks is recognized by all builders who have used them, and for uniformity in quality and beauty of appearance they are all that can be desired, comparing favorably with the celebrated Baltimore and Philadelphia bricks.

While iron is becoming more and more popular as a material for the interior construction of buildings, its employment is not by any means so common as it should be. When it is remembered that there is at present but a slight difference between the cost of iron and wood beams, and the immense advantage possessed by the former over the latter, their adoption should become general in the erection of warehouses, stores, offices, depots, and other buildings where the liability to fire is so great as to render the employment of fireproof material, interiorly as well as exteriorly, almost a necessity. Messrs. Carnegie Bros. & Co., of Pittsburgh, Pa., are extensive manufacturers of wrought-iron beams and girders, and will be glad to furnish estimates for all beams complete for any specific structure, so that the difference in cost can at once be ascertained.

Cottage Residence.

On the opposite page we give two floor plans and two elevations of a comfortable though not large cottage, designed for erection on a corner lot, or an extra wide village lot, by F. T. Camp, architect, of 335 Broadway, New York.

The problem was, to so plan, that either of three fronts could be used to face a street, and have either of said fronts as sightly as the other; also to have no waste room in halls and passages, and to have the sleeping rooms above large enough, but not as large as the living rooms below, but with good closet room; and, withal, a picturesque exterior, the effect gained by common sense and necessary breaks in roof and cornice outline, and not as is too common, by useless pediments, and meretricious scroll-sawing.

As the design was intended to be executed in a temperate rather than a cold latitude, the latticed shed attached was intended to provide sufficient room in warm weather, to have the washing done there, instead of in the kitchen. Cellar under center part of house only, and stairs to it under main stairs, out of China closet—the rest a foundation merely. Fire-places in the two principal chimneys, in both stories. A bay in the parlor enlarges it, while the dining room is part library, two book-cases being located one on each side of the chimney breast. These two rooms and hall are nicely *en suite* for gatherings, and above all, the openings have been carefully studied, so as to leave plenty of places for large pieces of furniture—this important duty of the planner is one most frequently slighted by the inexperienced, to the great and lasting discomfort of any occupant the house may ever have. A kitchen of ample room is supplemented by a large pantry for special kitchen use, and the china closet is of equal proportions, as it serves also as a passage to cellar stairs, while a narrow hall communicates with stair hall, from kitchen, so that a servant can attend door without disturbing the occupants of any room. There are, between the dining room and kitchen, the two doors of the china closet, so that the odors of the cookery will not penetrate where they are not wanted. A simple remedy for that very common annoyance can be provided in any kitchen, by a little work, and less expense. Make an umbrella-shaped cowl, out of stiff pasteboard, and a heavy wire edge, large enough to completely cover the stove, and connect the hole in its top with a valve ventilator in the chimney flue—not smoke flue—hang it as near the stove as the hight of a person will allow, and all odors will be carried off in the current induced by the heat of the stove. Of course, when no cooking is going on, the valve may be closed, to retain the heat if it be winter, or kept open, to dispense with the heat, if it be summer.

The veranda occupies a central position, and its balcony, surmounting it, creates a desirable lounging place to the second story.

In the second story are two large, and two small rooms, each bed-room provided with ample closet room, and the bath located in the most suitable position. Over the central portion is an attic, which could be reached by stairs over the main flight, if desired, but on account of its subordinate uses as a trunk room, lumber room, etc., a flat stepped ladder near the bath room will be found sufficient. A built-in wardrobe, with drawers in the lower part, in hall near bath-room will supply accommodation for the table and house linen, and a hat closet will be found ensconced in the first hall, under head of stairs.

It will readily be seen there is not an inch of room given to any room hall or closet more than is needed, and in such a compactly planned house, living may be accomplished with less waste, and more economy, than in apartments connected by long halls, totally separated from each other, standing in an unbroken line down the lot—a type too common, and indicative of penurious economy in securing a competent planner, and useless waste in all the departments of living.

This house can be erected in the neighborhood of New York city, in plain style, for $3,000, and we will furnish all working drawings and specifications, as below, necessary for its erection, for $50.

SPECIFICATION.

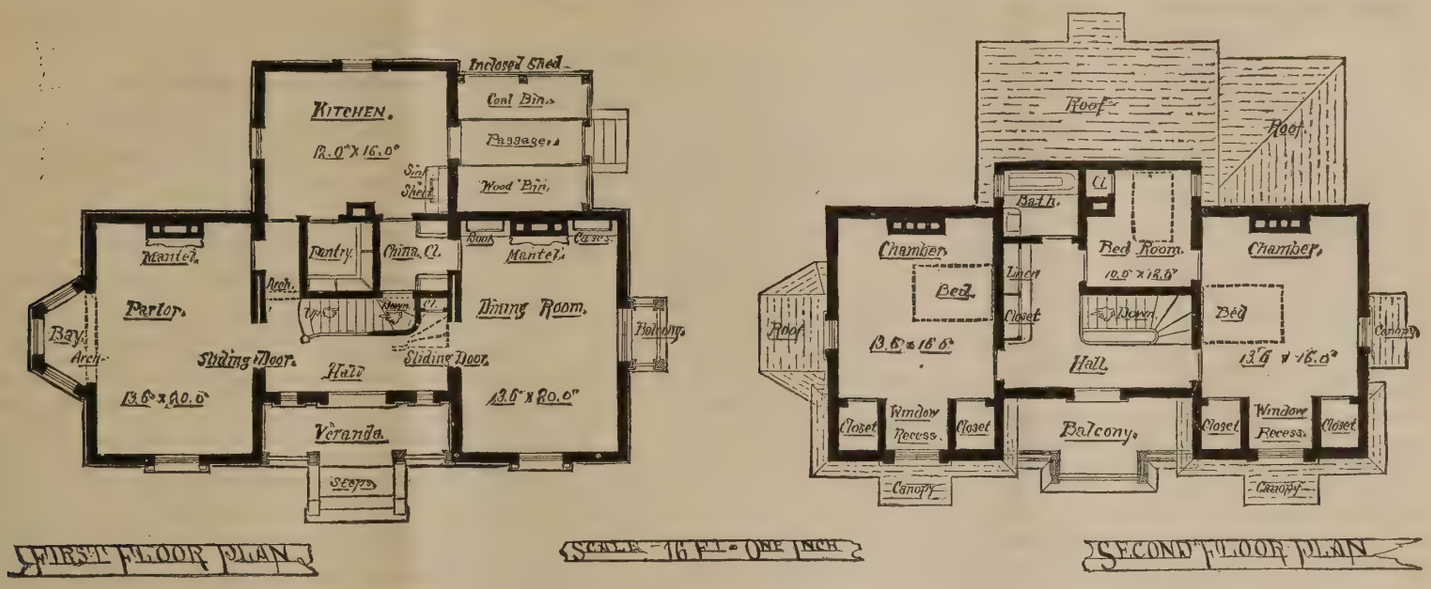
Cellar and foundation walls of native building stone, set on footings of large flat stone laid crosswise of the trench, laid in brown mortar of the usual richness. Stone walls to extend to grade only; above grade, of brick to sill; stone walls 20 inches thick, brick walls 12 inches. Chimneys start on stone footings; cellar under center part of house only—that is, hall and kitchen; excavation made accordingly, and all superfluous earth left after grading lot as desired by proprietor, to be removed by contractor. Cesspool or drain to sewer laid in satisfactory manner, as situation requires. Sills to cellar windows, also lowest steps of outside stairs from veranda, shed, etc., of cut stone; copings of chimneys also of cut stone. Cellar 7 feet high in the clear, and top of first-story floor to be 3 feet above finished grade.

Superstructure to be of wood. Sills, 4x6 inches; studding, 2x4 inches; girders, 6x10 inches; floor beams, 2x10 inches; ceiling timbers, 2x6 inches; partition caps, 4x4 inches; braces, 2x4 inches; bridging, 2x2 inches; rafters, 2x8 inches; ridges, 2x12 inches; veranda sills, 4x6 inches; floor beams, 2x6 inches; all of sound spruce or hemlock, as the market affords. All main framing of balloon style, flat-footed, and thoroughly spiked, braced and bridged. First story, 10 feet 10½ inches high; second story, 9 feet high. Sheathing, both of roofs and side walls, of gang-sawed hemlock market boards, laid edge to edge, and thoroughly nailed at every bearing twice, and at butts thrice, with 8-penny commons. Corner boards of 1½-inch stock; friezes and bands of ⅞-inch, furred to 1½ inches, friezes included, and sparingly perforated for ventilation and ornament. Window frames, door frames, bay-window finish, etc., of 1¼-inch stock, as shown; cornices of ⅞-inch plain facia and plancher, with bead 1½ inches under projection of slate. Trusses under window canopies, brackets in cornices, and gable finish 4 inches thick, boxed up from ⅞ inch stock. Veranda posts and finish boxed up from 1¼-inch and ⅞-inch stock; balcony posts the same; railing of 1½-inch; lattice on shed of ½-inch; corner boards and other finish of same, ⅞-inch. Steps—treads of 1½-inch stock; risers, ⅞-inch. Veranda and balcony floors of Georgia pine, tongued and grooved, not over 3 inches wide, and joints laid in thick white lead paint and blind nailed.

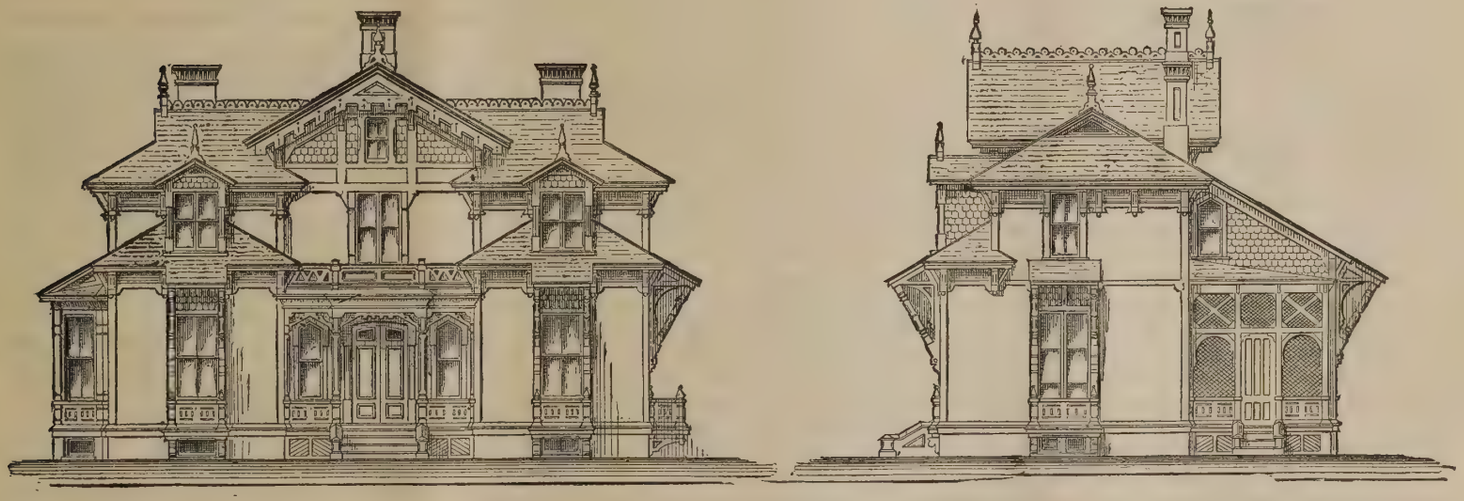
Sash from 1½-inch stock; outside front doors, 2½ inches thick; side door, 2 inches; sliding doors, 2 inches; other room doors, 1¾ inches; closet doors, 1¼ inches; cupboard doors, ⅞ inch. Sash with lights as shown, hung with pulleys and weights, in boxed frames. Sliding jambs of Georgia pine, oiled, plain ogee, and glazed with second-quality double thick French sheet glass, well tinned and puttied, and fastened with approved locks. Front doors raised molded, 1¾x3 inches, glass in upper panels, alike on both sides; side door, sliding doors, and dining-room door to china closet, one side flush molded with ⅝x1½-inch; all other doors ogee molded on the solid on stiles and rails; all doors four-panelled. Front doors trimmed with three loose-joint japanned iron silver-tipped acorn butts to each door, brass front and strike lock and latch combined, with night-latch, on right-hand leaf, and edge flush top and bottom bolts on left-hand leaf, both leaves having dark lava knobs and double escutcheons; bell-pull and rose of same goods. Other outside doors three loose-joint iron butts to each; door from dining-room to china closet three butts like front door; all other doors two loose-joint iron butts to each, and all trimmed with brass front lock and strike-lock and latch combined, with steel keys, white porcelain knobs, roses and escutcheons, and silver-plated screws. Sliding doors hung from top on approved double wheel sheaves, on hard wood track, trimmed with astragal front lock and catch and flush spring handles, all of brass, with brass screws.

Floors of dry pine, narrow, tongued and grooved, free from large or rotten knots, sound, and blind nailed. Best on first story and poorest on attic.

Lath of pine or hemlock, well nailed, to extend below base and wainscoting grounds, covered with scratch coat well haired, and browning coat well smoothed; angles well turned, and a third coat of lime putty and white sand or marble dust, well polished. Angles in hall and two principal rooms to have neat light stucco cornices, 4x7 inches and 6x11 inches respectively, and said apartments to also have neat centers of cast plas-



FIRST FLOOR PLAN. SCALE 16 Ft. = One Inch. SECOND FLOOR PLAN.



FRONT ELEVATION. SIDE ELEVATION.

F. T. CAMP — ARCHITECT. No. 335 BROADWAY N.Y.

DESIGN FOR COTTAGE, COSTING FROM $2,750 TO $3,000.

ter of the average value of $2 each.

Book cases in dining-room to have glass doors above, four drawers below, and shelves above, the whole 8 feet high. Wainscoting in kitchen 3 feet high, capped, of ¼x3-inch pine, with joints V-grooved instead of beaded, and well nailed to three bearings. Bath-room also wainscoted in similar manner. Bases in first-story hall and principal rooms, 10 inches high, including 2½ raised molding; bases in second story, 8 inches high, including a 1½-inch flush molding; closet bases, 6 inches high, plain bevel. Architraves of principal rooms 7 inches wide, with 3-inch band molding with plinths for first story, and 5-inch stuck molding in second story; kitchen and closet sides plain 5-inch. Shelving in closets as shown, and over sink, also hooks on cleats, neatly beaded, on walls as usual.

Sink to be of cast-iron, enamelled, and open underneath; bath-tub cased around; water-closet of cast porcelain, uncased; tub, 14-ounce copper planished, over-flow, strainer, and waste complete; boiler of best quality heavy boiler iron, galvanized, on stand, and connected with fire-back by 3 A lead pipe. All other hot and cold water pipes of galvanized wrought-iron, joints red-leaded, thoroughly stayed, levelled, dripped, and made complete. Circulation pipes to bath-tub and sink of sizes suitable to their several situations. Soil pipe of 4-inch cast-iron, joints calked and leaded, connecting with galvanized iron pipe, which is of same bore, leading to kitchen chimney flue in attic, for ventilation of same. Soil trapped before entering sewer or cesspool; water-closet trapped, and all wastes trapped before entering soil pipe. Gas pipe of standard city size, laid for illumination of all first-story rooms from centers of ceilings, and all second-story rooms from walls, two points in chambers and one each in other rooms.

Stairs to be constructed of pine, with black walnut rail, newel, balusters and brackets; treads, 1¼ inches; risers, ⅞ inch, housed in wall string, nosings mitered on face of string, well wedged up and glued on carriages sufficient; rail, 2½x4 inches, toad-back; newel, 10 inches square, turned neckings top and bottom, cap, and octagon shaft; balusters, 2 inches square, of a similar pattern; brackets, ¼ inch, put on after painting is completely done. Cellar stairs of rough pine, treads and risers, and plain hand rail and balusters.

Roofs slated or shingled; chimneys flashed with 2-pound lead. Mantels in four rooms of marbleized slate. Grates, fenders, etc., in two first-story rooms. Finials and cresting of wood.

Siding of 5-inch bevel clapboards, over heavy building paper, laid 4 inches to the weather, securely nailed, with heads well set in. Black walnut wood-work, oiled once and shellacked two coats; all other finished wood-work, outside and inside, to have three good and sufficient coats Atlantic white lead and boiled linseed oil paint; sash, dark brown; frame-work, chocolate brown; siding, French gray; ceiling of veranda, light blue. Inside—stiles and rails, rose; panels and flats, lavender—just tints.

One bell and one speaking-tube in kitchen. Case all pipes that show, and do not nick floor timbers for passage of pipes.

General Suggestions about Gardens, Fences, and Foundations.

We copy the following excellent article from the Boston *Journal of Chemistry:*

"There is a great deal of money spent, and much of it wasted, in the laying out of grounds. The waste comes from the lack of expert direction as much as from any other cause. When amateur ambition is content with the ordinary experimental gardening, the gain in health may more than compensate for the loss of money; but to construct a combination of formal Italian terraces in the place of wild ground, or to make from a plain a picturesquely varied rural park; to plant or remove trees; to effect important changes in grade; to provide proper surface and subsoil drainage; to create water courses, ponds, and fountains, these may either be made by the hobbies of ignorance, on which recklessly to expend a fortune, with little or no return of advantage, or, properly conducted and directed, they may be a source of real pleasure to the immediate owner, and of lasting benefit to himself and his neighbors. On limited grounds the loss would be proportionally reduced; but if the work is not wisely ordered, the result will still be wasteful. Not a shovelful of earth should be shifted without the aid of a well-considered plan. *It is not what is done that costs, so much as that which has to be undone and done over again.* In small schemes of landscape gardening, the form and character of the house become of great importance in relation to the natural features of the site, and the original characteristics of the latter must be carefully considered in connection with the plan and design, in order to make as much of the combination as practicable.

"The ground should ordinarily slope away from the walls, and proper provision should be made to carry away, by surface gutters or underground drain pipes, the rain-water delivered from the roof by the leaders or conductors, unless such water may be required for domestic purposes, in which case it can be received and stored in a tank in the attic, or in a cistern underground, or in the celler. The first position saves pumping, while the others insure a greater degree of coolness.

"The extravagance in fences in this country is growing to be a matter of serious importance. The desire for reasonably evident and distinctive boundaries and inclosures of one's land, and a prudent degree of reserve and seclusion, is commendable, and is well expressed by the old English proverb, 'Love your neighbor, but do not pull down the hedge.' Popular feeling does not incline to the so-called 'park system' of building—that is, a tract of country laid out by a combination of owners in one general scheme, and without visible separation of ownerships. It smacks rather too much of communism for Anglo-Saxon tastes. On the other hand, such domestic fortifications as heavy walls of cut stone, high and elaborate iron fences, or even the more costly and pretentious wooden ones, are usually an injury to the appearance of ordinary grounds.

"An old-fashioned farm stone wall, overgrown with masses of woodbine or wild grape-vines, is as pleasing a form of fence as can be devised; but, in deference to the desire for a more accurate and formal barrier, a strong, plain, wooden construction, with rails or pickets, or other simple pattern of straight pieces, from 3½ to 4 feet in hight, and painted some dull, dark shade of gray, brown or red, which will harmonize well with the neighboring color effects of nature, is all that can ordinarily be required. In the best Japanese and Swiss wood-work may be found many good suggestions for simple and tasteful combinations of straight, or nearly straight, slats and sticks. Such unobtrusive barriers define the limits of property sufficiently against trespassers, while they do not too bluntly repel a friend, or cut the curved lines of beauty in nature by the harsh, straight divisions of human ownership.

"The money lying idle and unproductive in fences in this country might not be enough to pay the interest on the national debt, as the amount spent on fire insurance is said to be,* but it would be a very snug sum, and useful for a variety of purposes.

"Some of the stone that is misemployed in fences might well be utilized in foundations. If the natural product of the neighboring ledges is suitable—that is, if it can be procured at a fair price, and is reasonably durable, and can be split into pieces with two flattish surfaces approximately parallel—it will probably prove the best material, at least for that part of the cellar wall which is underground. For the part which shows above, and which commonly goes by the name of 'underpinning,' a better quality is required. In many cases, good, even-colored, hard-burned brick, laid in black mortar, would be preferable. The black mortar is used only in the outer or exposed joints. It should not be made, as formerly, by an admixture of lampblack, as this material has an oily consistency, and, to use a mason's expression, rots the mortar. 'Mortar black,' a cheap preparation of carbon, is preferable. In some cases, with either stone or brick, red pointing looks well, and the color can be produced by mixing dry Venetian red with the mortar. For ordinary rough stone-work, nothing looks or wears better than a filling of dark cement, smoothed over level, or flush with the surface of the wall. Ruled white-lead lines on dark cement are neither durable nor beautiful; they do not deceive any one into thinking that rough rubble-work is hammered stone with fine joints; and, failing of this, they can serve no other purpose.

"In laying the rough walls below ground, care must be taken that no stones project beyond the general outer surface within 5 feet of the level of the top of the new grade, as the earth freezing under such projecting stones is apt to raise and crack the wall. Cellar walls, ordinarily, should be about 2 feet thick at the bottom, which should be at least 6 inches below the finished cellar floor level, and from 18 to 20 inches thick at the top. The inside surface should of course be plumb, or perpendicular, the outer one having the batter, or slope. It is best to bed and point the stones solid in a mixture of one-third cement to two-thirds lime and sand mortar. The cement should be mixed fresh and put into the mortar not more than half an hour before use. The inside is, of course, to be pointed and smoothed up to make a finished cellar wall; and it is well to plaster up the outside pretty thoroughly, in a rough way, as a protection against surface water and the action of frost. Openings for soil or drain and gas and water pipes should be left when building, in order not to shake the wall by cutting them afterward. Piers or principal supporting partitions in the cellar should be of hard brick. If piers are used, they should never be less than 8 by 12 inches in horizontal section, and should have snug, level joints, and should start from broad footings of flat stone under the cellar floor."

New Publications.

Harper's Magazine for September presents many striking novelties, and in excellence of illustration is superior to all former numbers. One of the most novel features of this number is a ghost story by Howard Pyle, with eight illustrations drawn by the author. The story may be fascinating to some, but we regret that public taste calls for this class of fictitious literature; while we must confess that the pictures are the very best examples of character sketches—as fine as they are striking.

In the second paper of Mr. Benjamin's series, "Fifty Years of American Art," there are beautiful engravings after paintings by F. E. Church, Worthington Whittredge, R. W. Hubbard, J. W. Casilear, J. F. Cropsey, W. T. Richards, S. R. Gifford, A. F. Bellows, James Hart, James Hamilton, W. H. Beard, E. Leutze, William Page, Elihu Vedder, and John Lafarge. In excellence of engraving nothing could be superior to the sixteen pictures illustrating Barnet Phillips' interesting paper, "The King Collection of Engraved Gems," recently purchased for the Metropolitan Museum. Ernest Ingersoll's "Gold Mining in Georgia" takes us into a new and very interesting field, of which little is known. Edward Howland's paper, "An Industrial Society and its Work," presents a curiously remarkable series of coöperative plans successfully carried out in Mülhausen, offering many useful suggestions to those interested in the welfare of laborers.

The magazine, as usual, is worth all it costs.

A Practical Treatise on Lightning Conductors. By Henry W. Spang. Philadelphia: J. Fagan & Son.

This pamphlet, which is illustrated with the necessary wood-cuts, explains the defects of lightning conductors as now in use, and shows how metal roofs, or sheet metal bands beneath wooden or slate roofs, in connection with the ordinary rain pipes, will prevent buildings from being destroyed or damaged by lightning. It is an addition to a little volume published about a year ago, with the view of introducing the writer's improved system. His ideas in regard to the subject are sound, which is more than can be said of other writers of little books on lightning rods, especially those who make the erection of the latter a business. He attaches proper importance to the perfect ground connection, and is free from the foolish prejudice that the rods must be isolated from the building by glass rings, and other nonsensical precautions. We have only one objection to offer, which is that he trusts too much to the rain pipes; these are often in a bad condition—corroded, and even disconnected. We agree with his whole system of rods on the chimneys, strips of metal under the roof, etc., but we should prefer to have an additional connection with the ground, besides the rain pipes—a connection not so subject to damage as the latter, because in case these become damaged and inadequate as conductors, when lightning strikes without rain, all the rest become a source of danger instead of protection.

This book should be in the hands of all lightning rod men; they can learn something by reading it.

Ethics or Science of Duty. By John Bascom. New York: G. P. Putnam's Sons.

The author of this book is known as the writer of "Principles of Psychology," "Growth and Grades of Intelligence," "Philosophy of Religion," etc., and the present publication may be considered as a link in the series—it is, in fact, an elaborate treatise on *Moral Science.* Like all books on this subject, there is a great deal of abstract reasoning, a great deal that could have been left out, and a great deal that could have been said with less verbosity. But the same may be said of most sermons, and the book, especially in its latter parts, reminds us of Christian sermons, notwithstanding the author spoils it for the orthodox by expressions like the following: "The doctrine of Christianity, often shaped by a defective logic from insufficient premises, has been found at various times and in various forms to involve false moral principles. . . . The character of God, and the methods of his government, as theologically conceived, were justified by a distortion or a denial of moral principles." Still it cannot be said that the author is not a Christian; the whole book shows his belief in that kind of revelation in which Christians generally believe.

Webster's Unabridged Dictionary. Illustrated. New Edition. G. & C. Merriam, Springfield, Mass.

We welcome this new edition of the celebrated Webster's Unabridged. It is a most invaluable work, as necessary in the family as in the school or higher institutes of learning, and also in the editorial sanctum. This new edition contains 1,928 pages and 3,000 illustrations, including a supplement of 4,600 new words and their definitions, together with a new biographical dictionary of nearly 10,000 names. The letter-press, as well as the engravings, are excellent, and a great credit to the enterprising publishers, who have neglected nothing to earn the acknowledgement that our country is foremost in this as well as in many other enterprises.

PAMPHLETS RECEIVED.

We are indebted to the American Institute of Mining Engineers for the following papers: "Discussion of Dr. Charles B. Dudley's Papers on Steel Rails, read at the Lake George meeting, October, 1877." "Regenerative Stoves," a sketch of their history and notes on their use. "On the Use of Determining Slag Densities in Smelting," by Thomas Macfarlane, Wyandotte, Mich. "Proceedings of the Pittsburgh Meeting." "On an Apparatus for Testing the Resistance of Metals to Repeated Shocks," by William Kent, M.E., Pittsburgh, Pa. "Note on the Wear of an Iron Rail," by W. E. C. Coxe, Superintendent of the Philadelphia and Reading Railroad Rolling Mill, Reading, Pa. "The Antimony Deposits of Arkansas," by Charles E. Wait, C.E., M.E., Director of the School of Mines and Metallurgy, Rolla, Mo. "The Working of Three Hearths at the Cedar Point Furnace, Port Henry, N. Y.," by T. F. Witherbee, Port Henry, N. Y. "Pittsburgh, its Resources and Surroundings," by William P. Shinn, Pittsburgh, Pa. "Sketches of the New Mining District at Sullivan, Me.," by C. W. Kempton, Mining Engineer, West Sullivan, Me. "The Tessié Gas Producer," by A. L. Holley, C.E., LL.D., New York. "On Some Curious Phenomena Observed in Making a Test of a Piece of Bessemer Steel," By William Kent, M.E., Pittsburgh, Pa. "Accidents in the Comstock Mines, and their Relation to Deep Mining," by John A. Church, Mining Engineer, New York.

"Quarterly Report of the Chief of the Bureau of Statistics," Treasury Department, relative to the imports, exports, immigration, and navigation of the United States for the three months ended June 30, 1878; December 31, 1878: and March 31, 1879.

* The cost of fire insurance for the United States, including the expenses of the insurance companies and of the fire departments, which might be saved by fire-proof buildings, is $180,000,000 per annum, according to the statement of the Boston Manufacturers' Mutual Fire Insurance Company.

Notes and Queries.

This department is intended to furnish, for the benefit of all our readers, information on any subject of scientific or practical knowledge falling within the field of The Manufacturer and Builder. *All persons possessing additional or more correct information than that which we give relating to the questions, are cordially invited to communicate it to us for publication. We also request that all questions or answers be written on separate pieces of paper, and addressed to the Editor.*

QUESTIONS.

(2452) The Treatment of Imaginary Quantities.—I have seen your reply to my Query (2421) on page 168 of your July number, and wish to say that I am much favored with it. I have studied both "Olney's University Algebra" and "Greenleaf's New Higher Algebra," and they teach that $\sqrt{-1}\times\sqrt{-1}=-1$. You see why I was wrong. The first example on page 80 of "Olney's Algebra" is as follows: Multiply $4\sqrt{-3}$ by $2\sqrt{-2}$; according to the teaching that $\sqrt{-1}\times\sqrt{-1}=-1$, $4\sqrt{-3}\times 2\sqrt{-2}=4\sqrt{3}\sqrt{-1}\times 2\sqrt{2}\sqrt{-1}=8\sqrt{6}(\sqrt{-1})^2=-8\sqrt{6}$. Your mode of treating imaginaries would give in the above $4\sqrt{-3}\times 2\sqrt{-2}=4\sqrt{3}\sqrt{-1}\times 2\sqrt{2}\sqrt{-1}=8\sqrt{6}\sqrt{-1}$, if I understand your explanation. Please answer and oblige.—M. S. H., Knightville, Maine.

(2453) A Fine Black Stain for Wood.—Can you give me a recipe to produce a fine stain that will make wood look like ebony?—S. S., Copper Hill, Va.

(2454) Clear and Milky Ice.—Which ice is the better, clear or milky? I have heard it said that the milky ice is unwholesome.—T. R., New York City.

(2455) Curing Sores and Pustules.—What is the best salve to apply to pustules and sores?—D. G., Ithaca, O.

(2456) Horse-Power.—Please explain what a horse-power is.—J. S., Jacobstown, N. J.

(2457) The Hottest Mines.—I see that the highest temperature experienced in English coal mines is reported by the Coal Committee there to be 106° F. Is this not about the highest temperature miners can stand? I hope we do not surpass this, as we do the old world in many things.—S. N., Pott's Grove, Pa.

(2458) Repairing Brick Sewers.—What is the best way to repair a fallen-in brick sewer, without interfering with the flow of the water in it? Can it be done without making side trenches for temporary discharge? I suppose in New York you have some way of doing this without interfering much with street travel.—D. L., San Francisco, Cal.

(2459) Japan Varnish.—Can you give me a recipe for putting a black shiny gloss on the stack and front end of a locomotive? I have tried boiled oil varnish, japan, etc., and mixed them, but to no purpose. If you can give me what I want, you will oblige.—An Ohio Boy.

(2460) Terebine.—What is Terebine, and where can I get it? I think it is a substance from the pine tree, well known in England, and probably in this country, but I am ignorant of it.—E. H. C., New York City.

(2461) Classification of Stone.—Which is the hardest, densest, and strongest of the common paving and flagging stones used in this city?—F. M., New York City.

(2462) Testing Eggs.—What is the best way to determine whether eggs are fresh or old, and how old?—G. L., Newberrytown, Pa.

(2463) Cheap Black Stain for Pine or Whitewood.—Can you give a recipe for a cheap black stain for pine or whitewood?—J. R., Marilla, Mich.

(2464) French Shoe Polish.—Will you please inform me of the composition of the French polish or varnish for leather, which is also manufactured in the United States, or of another polish that would answer the same purpose.—P. L., Montreal, Canada.

(2465) Coloring Wood Black Like Old Oak.—How can I imitate the brown color of old oak? and also color wood black?—R. B., Gholsonville, Va.

(2466) Sea and Mountain Air.—Which is the better for health, sea or mountain air? Where is it the more wholesome, at Coney Island or on the Catskill Mountains?—D. W., Washington, D. C.

(2467) Dissolving Glue.—Seeing a recipe for making a cement in your journal, and having occasion to use a strong cement, I endeavored to make some, but was met at the outset with a great difficulty. I allude to "Peasley Cement," on page 122 of your April number for 1869. The difficulty is to distinguish between solids and liquids, and the absence of anything to start from, such as weight, etc. If you could favor me with some plan by which I can make it, I would take it as a great favor.—J. G., Baltimore, Md.

(2468) Blasting Gelatin.—Can you give any information in regard to the new explosive invented by Nobel—the blasting gelatin? How is the glue or gelatin treated to make it explosive?—L. B., Limington, Me.

(2469) Making a Telephone.—Please inform me how I can construct a telephone that will work a distance of half a mile, or even a little less.—J. H. M., Worcester, Mass.

(2470) Making a Photographic Apparatus.—How can I construct a simple photographic apparatus, for amusement at home?—J. H. M., Worcester, Mass.

(2471) Book on Draughting.—Will you be kind enough to give me the title of a good work on draughting for a beginner.—F. M. S., Newark, Ohio.

(2472) Measuring Water for Water Wheels.—What is the simplest way to measure the amount of water that a flowing stream gives? How can I calculate the power from the amount found?—G. S., Fulton, N. Y.

(2473) Dead Black for Brass.—What is the method used to blacken the interior surface of tubes of optical instruments, such as telescopes and microscopes, with a black without gloss? I tried black varnish, but it reflects the light, and is therefore objectionable.—S. N., Charlestown, Mass.

(2474) Bluing Steel.—How can I give to steel or polished iron the blue color of watch springs?—J. E., Danbury, Conn.

(2475) Speed of Saws.—Please give the required velocity for rotary saws for wood.—C. M., Humburd, Wis.

(2476) Mounting Lenses.—How are the lenses of spyglasses fixed in their mountings? I find that a brass edge is turned over the glass. How is this done?—R. A., Troy, N. Y.

(2477) The Fastest Railroad Time.—What is the fastest time regularly made by certain railroad trains?—T. K., Salisbury, Md.

REPLIES.

(2452) The Treatment of Imaginary Quantities.—You understand the explanation. That the books are wrong in teaching that $\sqrt{-1}\times\sqrt{-1}=-1$, is easily proved by the false results which you obtain when accepting this doctrine. If the expression, $\sqrt{-1}\times\sqrt{-1}$, were to be treated as other quantities under a $\sqrt{}$ sign, we would also be justified in writing $\sqrt{-1}\times\sqrt{-1}=\sqrt{(-1\times-1)}=\sqrt{+1}=1$. Take now, for instance, the same expression, $4\sqrt{-3}\times 2\sqrt{-2}$, and square it, or reduce $(4\times 2\times\sqrt{-2}\times\sqrt{-3})^2$ this is $(8\times\sqrt{+6})^2=64\times 6=384$, and we would have that $\sqrt{384}=4\sqrt{-3}\times 2\sqrt{-2}$, and this is absurd as $\sqrt{384}=\pm 8\sqrt{6}$, and only an irrational positive or negative, but never an imaginary quantity.

(2453) A Fine Black Stain for Wood.—You must take a close-grained, dense wood, not ash, chestnut or oak, but some wood like cherry, pear, maple, beech or box. The wood is first stained with a decoction of logwood, which can be purchased from any druggist or dealer in dye-stuffs. An excellent logwood preparation comes in paper boxes, and looks something like bitumen. This is dissolved in warm water until all has been taken up that the water can hold. Application to the wood may be made freely with a large, soft-bristle brush, and the surface then rubbed with a cloth to prevent the formation of a gummy coat thereon. The article is then left to dry for a few hours. The second application is of vinegar in which a quantity of nails or clean iron filings have been soaked for a few days. This is also applied freely with a brush. The moment the vinegar touches the wood it combines with the logwood solution in the pores, making an ink which is a permanent jet black stain. If any tendency to grayness is noticed, a second treatment with the logwood and vinegar may be necessary; but this seldom happens if the materials have been properly used in the first instance. The iron in the vinegar must not be forgotten, as it is this which really does the work. When perfectly dry, it is varnished and rubbed down, or finished with oil well rubbed in, and a dead black surface is the result.

(2454) Clear and Milky Ice.—Milky ice is not dirty ice; it simply contains a great number of air bubbles. Whiteness always results from the intimate and irregular mixture of air with a transparent solid; ground glass, table salt, and other transparent articles become white when pulverized or severed, and air thus admitted. Of course salt is just as free from impurities in the opaque form of fine white powder as in the transparent form of crystals; it has simply ceased to be transparent, and it is by the operation of the same natural law of light that clear, limpid water often makes white ice, that frozen rain-drops of pure water fall as white hailstones, and that frozen cloud mist of pure watery vapor falls as snow. The color of ice thus depending on the expulsion of the air from the water during crystallization, it follows, first, that when the weather is intensely cold and the atmosphere favorable to abundant nocturnal radiation, the ice formed on still water or sluggish streams, containing more than the average amount of air, is apt to be whiter than usual; and second, that the ice thus formed is not the less pure because it is white, as its color is due to the presence of atmospheric air, which was not expelled in the act of freezing. This air is the same that we breathe and that all pure water is known to contain. Whiteness in ice being thus rather an index of purity than otherwise, the only remaining question is whether white ice is as valuable as the transparent product in an economical point of view. Tyndall tells us that he found among the glaciers of the Alps ridges of white ice, and that they invariably stood three or four feet above the general level of the blue ice. The difference in their hight, as compared with the latter, is of course due to their greater power of resistence to the sun's rays, which are the only melting influence to which they are subject in those regions of eternal frost. White ice exposed to the sun's rays will last longer than transparent ice, bulk for bulk and weight for weight. Thus it appears that its color does not detract from, but rather adds to its commercial value.

(2455) Curing Sores and Pustules.—Do not use salves by any means; they will keep a spot sore, which will heal of itself if you do not apply any salve. The best applications are poultices, either of ground linseed or of bread and milk; the latter is the mildest, and has healing properties. When pustules have a malignant look, such as are often caused by the bite of an insect, a disinfectant is to be recommended; one of the mildest is simply earth, not sandy, but clayish—best taken from a flower-pot; even mud will do, provided it is not taken in the neighborhood of a stable, but pure earthy mud from the country. To prove the disinfecting properties of earth, you have only to lay plants with their roots in a cup of pure water, and in a short time the water will become putrid; but if you put them into moist earth there will be no bad odor, while the plants will grow. The earth closet is another proof of the disinfecting properties of earth. The temporary burial of the whole body up to the neck in earth, is, in some cases, successfully applied in semi-civilized countries, and civilized people may as well take advantage of this valuable property of earth, which is not as well known as it deserves to be.

(2456) Horse-Power.—We have so fully explained this in our series of articles on "Steam Engineering," that we refer to the same for full information. However, we will give here a condensed explanation. A horse-power is a unit of power established by James Watt, equivalent to lifting 33,000 pounds one foot per minute, which is the same as 550 pounds lifted one foot per second—that is to say, one horse-power is 550 foot-pounds, or 11 man-power of 50 foot-pounds per second each. The product of any force in pounds and its velocity in feet per second, divided by 550, gives the horse-power in operation. In Watt's rule for a horse-power is given a velocity of only one foot per minute, which is equal to 0.2 or one-fifth of an inch per second—about the velocity of a snail. The force corresponding to this velocity is 33,000 pounds, or about 15 tons, which is too large for a clear conception of its magnitude, and a horse can never pull with such a force. A horse can pull 550 pounds with a velocity of one foot per second, which is the most natural expression for a horse-power. This expression is used on the continent of Europe as follows:

Countries.	Terms.	Units.	Eng. equiv.
English.....	Horse-power.	550 foot-pounds.	550 foot-lbs.
French.....	Force de cheval	75 kilogr. meters.	542 foot-lbs.
German.....	Pferde-krafte.	513 fuss-funde.	582 foot-lbs.
Swedish.....	Hast-kraft.	600 skalpund-fot.	542 foot-lbs.
Russian.....	Syl-lochad.	550 fyt-funt.	550 foot-lbs.

Important Remark.—We ought to add here a correction of misstatements we find very frequently made in books and papers, namely, that a horse-power, or 32,000 foot-pounds per minute, means a force capable of *moving* 33,000 pounds with a velocity of one foot per minute. Now this is absurd on the face of it, as one man can easily move a railroad car weighing more than this, when standing on a horizontal track, with a greater velocity than one foot per minute, and when once in motion the momentum will keep it going, and it will move many feet further without any force being applied. The 33,000 foot-pounds mean the power required to move the 33,000 foot-pounds vertically upward against gravitation, or lifting it. This statement makes it conform to the sense in which we use steam power, which also means a lifting up; thus, 70 pounds per inch means that a safety valve of 1 inch surface will be lifted by the steam when charged with less than 70 pounds weight; if it is a vertical piston that is moved one foot, the steam will have exerted 70 foot-pounds when it moves it through that distance; and if it does this in one second, it will have exerted about one man-power.

(2457) The Hottest Mines.—We are sorry for our miners, but it is a fact that we surpass this, namely, in the deepest shafts of the Comstock lode—2,000 feet deep—belts are found as hot as 157°, while the water flowing through it has the same temperature. Fortunately, in our mines the ventilation is more perfect than in the English coal mines, so that the air is always cooler than the earth, coal or rock, which is by no means the case in England, where some of the Cornish mines have shown a temperature of 113°, while the hottest water encountered was 125° Fah. You will see that we beat this by some 32°. In newly opened shafts the air is hottest, and varies from 108° to 116°; but ventilation soon reduces this. The highest temperature of the air in which men worked, was, in one case, 123°. It is curious that belts of unusual cold rock are also encountered, intermingled with hot belts—a proof of the unreliability of the conclusions drawn from observations of the temperature of the water from artesian wells, and the theories of a regular increase of the temperature with the depth.

(2458) Repairing Brick Sewers.—Of course in New York city we cannot afford to stop street travel while repairing a sewer, by digging up the whole width of the street. The way in which it is done at present, is to dig down perpendicularly, and prevent the earth from falling in by the usual method of driving in boards vertically along the sides, and having them well braced, so as to keep them perpendicular. When the damaged sewer is reached, a sufficient amount of brick-work from the top is removed to place inside a square elongated tube, made of boards, from 12 to 16 feet long; it is made as nearly water-tight as possible, and when ready, the water is led through this box by daming it up under it where the water enters. The bottom of the sewer is then removed, and new brick-work, laid in hydraulic cement, substituted, until the lower half is ready. The water can then be turned in and the box removed, or passed into the adjoining section of the sewer if this is to be renewed; after the removal of the box the upper part of the sewer is finished. Of course each section has to be

dug up in succession, while over the finished parts it is filled in. In this way long sections of sewers are now repaired in this city. It used to be customary to lead the water coming out of a damaged and dug up sewer into a hollow expressly made for the purpose, and to pump it from this into the gutters, in order to keep the work free from water until finished; but the method above described is now preferred, especially on sanitary grounds, as the street gutters are not the proper outlets for sewage, especially when they run a long distance before reaching a sewer. It is also better not to pump and stir up sewage matter, but allow it to flow off as quickly as possible into the rivers.

(2459) Japan Varnish.—We do not see why good Japan varnish will not do. Of course linseed oil varnish cannot stand heat, but Japan can. If you cannot obtain any that will give satisfaction, you will have to make it; the recipe is this: Naples asphaltum, 50 pounds; dark gum anime, 8 pounds; boil for two hours in 12 gallons of linseed oil, then melt 10 pounds of dark gum amber, and boil with 2 pounds of linseed oil; add this to the other, with a sufficient quantity of dryer, (sugar of lead), and boil for two hours longer, or until a little of the mass, when cooled, can be rolled into pills; then take from the fire and let it cool. When you are about to use it, thin it down with about 30 gallons of turpentine. Be careful when boiling the oil to do it in a vessel on which there is a well fitting metallic cover, to which a long stick is attached, so that in case the boiling oil takes fire you can put the cover on, and so smother the fire at once without danger of burning your hands or causing a conflagration. The safest plan is to boil the oil in the open air, or under a shed, remote from buildings.

(2460) Terebine.—It is a substance made from turpentine oil by the action of sulphuric acid and distillation, similar to the way in which ether is made from alcohol. It can be used for the same purposes as oil of turpentine, but has the advantage of being perfectly uniform and homogeneous in composition, while turpentine oil is not; it is more fluid, has an agreeable odor like thyme, and never thickens nor changes, which turpentine does, being a very unstable and variable mixture of several volatile oils, resins and camphenes. We do not know where it can be obtained. If we wanted it, and had not time to make it, we would inquire of well known and prominent dealers in chemicals. We advise you to do the same.

(2461) Classification of Stone.—We can do no better than give you an extract from the Central Park report of 1872, which gives the following data: Hardness—1, granite from the State of Maine; 2, North River graywacke, commonly called bluestone; 3, Park gneiss; 4, Westchester county gneiss; 5, Westchester county white marble; 6, New Brunswick freestone; 7, New Jersey freestone. Density—1, Westchester county marble; 2, graywacke, or bluestone; 3, Park gneiss; 4, Maine granite; 5, Westchester county gneiss; 6, Dorchester freestone; 7, Albert freestone. The relative hardness is shown in the order named, No. 1 being the hardest. The relative density is also shown in the order named, No. 1 having the greatest density. The following experiments, made by Gen. Thomas J. Rodman, of the Ordnance Service, U. S. A., show its great strength:

Name of Stone.	*Density.*	*Crushing Strength per sq. inch.*	*Transverse Strength per sq. inch.*
North River graywacke	2,724	22,450	609
Rockport granite	2,645	15,296	374
Quincy granite	2,666	9,739	235
California sandstone	2,636	20,039	425

(2462) Testing Eggs.—The transparency test is very good; a fresh egg is transparent—a spoiled egg is opaque. To determine this transparency the egg is held before the light of a candle. A beautiful and scientific way is to pass the electric spark of a common friction electric machine through a number of eggs, laid side by side on an isolating surface. The interior illumination produced by the spark will show the transparency of a fresh egg or the opaqueness of a stale egg most strikingly. In order to ascertain how old an egg is, notice the shrinkage; a fresh egg is entirely full; within two weeks a small empty space is formed, while in three weeks it is about the 32d part of an inch; in six weeks, a 16th of an inch, and so on.

(2463) Cheap Black Stain for Pine or Whitewood.—One of the cheapest stains we believe is made thus: Take 1 gallon of water, 1 pound of logwood chips, ½ pound of black copperas, ½ pound of extract of logwood, ½ pound of indigo blue, and 2 ounces of lampblack; put these into an iron pot and boil over a slow fire. When the mixture is cool, strain it through a cloth, and add ¼ ounce of nutgall. It is then ready for use, and is a black good enough for all kinds of cheap work.

(2464) French Shoe Polish.—Take 5 pints of white wine, dissolve in it 8 ounces of gum senegal and 6 ounces of white sugar; put it over a slow fire so as to warm it without boiling; then put in 2 ounces of powdered gallnuts and 4 ounces of iron sulphate, (green copperas); stir it for five minutes, then remove from the fire, and when nearly cold put in 12 ounces of alcohol or wood spirits; then strain it through flannel, and bottle. Some makers also add ¼ ounce of extract of logwood and one-16th ounce of pearlash; in this case ⅓ or 1 ounce more of the sulphate of iron is added. This varnish is simply applied with a brush or sponge, and is much better for leather than the ordinary shoeblackings made from some kinds of black carbon like bone-black, with sulphuric acid.

(2465) Coloring Wood Black Like Old Oak.—First saturate the wood with a solution of anilin salt (sulphate of anilin), and then with caustic soda. Caustic potash alone gives a somewhat similar result, but inferior to that with simultaneous use of anilin salt. Wood may be colored black by treating it successively with anilin salt, bichromate of potash, and caustic soda, the wood being dried after each operation. The color thus obtained is very regular. The experiment succeeds with most all kinds of woods. These coloring methods are quickly and easily carried out, and are very inexpensive.

(2466) Sea and Mountain Air.—Sea air may produce the same benefit as mountain air, but each acts differently. The former acts more forcibly and energetically on constitutions that retain the robustness and internal resources to profit by it, while the latter acts more gently, and with slower efficacy, being thereby more suitable to weaker and less excitable organizations. From this important distinction, the conscientious physician, who has the safety of his patient at heart, ought to be able to discriminate whether the Catskill or the Coney Island air is better suited to the individual to whom he gives advice.

(2467) Dissolving Glue.—The amount of water necessary to dissolve the glue is omitted in the recipe, it being supposed that everybody was acquainted with the method in practice—it is to put plenty of cold water on the glue and let it soak over night; in the morning pour the excess of water all off, and it will be found that the glue is much swollen and softened, and requires nothing more than a moderate heat—a little below the boiling point of water—to become liquid. As the better qualities of glue absorb much more water than the inferior kinds, the quantity of water necessary to dissolve say one pound of glue, is quite variable, therefore no reliable measure can be given. It is the same with isinglass, which is nothing but another kind of glue. Gum tragacanth takes still more water; this and the gum arabic are dissolved in as much water as will give to each the consistency of thick syrup. The same is done with the solution of shellac in alcohol; when all are mixed and white lead added, it has a tendency to become thicker, but this is corrected by the glycerin and alcohol, which are not absolutely necessary for the sticking qualities, but only serve to preserve the mixture, as without them it soon spoils by the deterioration to which glue is subject when kept in a liquid state in closed bottles. If you leave the bottle open, and let the glue freely evaporate, adding water when it becomes too thick, you can keep small quantities of glue and mucilage without alcohol, any length of time, but not in closed bottles.

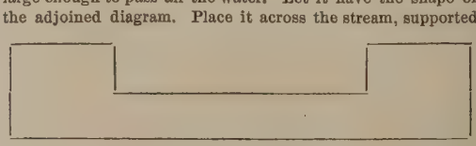
(2468) Blasting Gelatin.—We mentioned on a former occasion that this new explosive is not made from glue or gelatin, but by dissolving collodion of cotton in nitro-glycerin in the proportion of 10 per cent of the former to 90 per cent of the latter. The result of the solution is a gelatinous, elastic, transparent, pale-yellow substance, having a density of 1.6, and the consistency of stiff jelly. It is in itself much less easily affected by blows than ordinary dynamite, but may be rendered far more insensible to mechanical impulse by an admixture of a small proportion (from 4 to 10 per cent) of camphor. Experiments have been carried out, the result of which is to prove that the new explosive possesses, weight for weight, 25 per cent, and bulk for bulk, 40 per cent more explosive power than ordinary dynamite. With moist gun-cotton gelatin compares nearly as favorably. The temperature at which it explodes is about 204° C., when heated gently, and 240° C. when heated suddenly. The addition of camphor, however, seems to raise this point to from 300° to 330° C. Water has little or no effect upon this substance; it may be burned in considerable quantities without any fear of an explosion, and it is as stable and durable as either dynamite or gun-cotton. The cost of production is half as much again as dynamite, and about the same as that of compressed gun-cotton. We understand that a factory has been erected in Scotland for its manufacture. The Austrian Military Committee has pronounced it as highly suitable for military purposes.

(2469) Making a Telephone.—On page 277 of our December number for 1877, you will find an illustrated description of the telephone, with such details as will answer your inquiries; while on page 288 of the same number we have answered the very same question, with some additional suggestions.

(2470) Making a Photographic Apparatus.—We have treated this subject fully in an illustrated article on "Amateur Photography," which you will find in our April and September numbers (pages 84, 208 and 209) for 1876, to which we refer you.

(2471) Book on Draughting.—We recommend Warren's book on "Drafting Instruments and Operations," reviewed on page 190 of our August number.

(2472) Measuring Water for Water Wheels.—When the stream is small and shallow enough for a single board to reach across it, the simplest way is this: Cut a notch in the board large enough to pass all the water. Let it have the shape of the adjoined diagram. Place it across the stream, supported



by the banks at both ends, for which purpose a few poles are driven in the ground, and also some short stakes in the bottom of the stream, so as to keep the center of the board in place; close up all leaks with sand or earth, so as to force all the water to pass over the notch. The latter should be bevelled, with the sharp edge at the down-stream side. Drive a stake into the ground about one foot above this dam, and make its top at exactly the same level as the bottom edge of the notch. This stake then serves to measure the hight of the water above the discharging level. On the notch itself you cannot measure this hight, as the water just over it has already begun to descend below the level beyond. The locality for placing this board must be so selected as to form a little pond above it, in which the water will have time to come to a level surface. All that is then to be done is to measure the hight of the water above the stake—that is, above the discharging edge—in inches and fractions of inches, being careful to take this measurement only after the water has reached it greatest hight and the discharge has become uniform. The following table will then give the number of cubic feet, in hundredth parts, discharged per minute for every inch width of the notch:

Inches.	*Parts of Inches.* ¼	½	¾
0	0.05	0.14	0.26
1	0.40	0.55	0.74	0.93
2	1.14	1.36	1.59	1.83
3	2.09	2.36	2.63	2.92
4	3.22	3.52	3.83	4.16
5	3.50	4.84	5.18	5.54
6	5.60	6.28	6.65	7.05
7	7.44	7.84	8.25	8.66
8	9.10	9.52	9.96	10.40
9	10.86	11.31	11.77	12.23
10	12.71	13.19	13.67	14.16
11	14.67	15.18	15.67	16.20
12	16.73	17.26	17.78	18.32

It may be well to explain the use of this table by an example: Suppose we have thus made a weir 8 feet wide, while the depth of the water over it is found to be 9¾ inches. We look in the table and find for 9 feet 10.68, and for 9¾ inches 12.23 feet, this representing the number of cubic feet which this weir will discharge per minute for every inch of its width; it has to be multiplied by this width, or 36, and gives 36×12.23, or 440.28 cubic feet for the discharge per minute. The table here given can be used for greater depths, by taking half of the depth found, finding the number corresponding with this, and multiplying this number with the constant quantity 2.85, which will give a result near enough for all practical purposes. In order to find the horse-power to be obtained from this water, the fall must be measured—that is, not merely the fall over the dam, but the vertical distance between the highest level behind the dam and the lowest level disposable; this hight, multiplied with the number of pounds of water discharged, gives the number of foot-pounds, and this divided by 33,000, the amount of horse-power. To illustrate this by an example, let us suppose that in the above calculated case of 440.28 cubic feet of water the total fall is 10 feet, we first reduce the cubic feet to pounds by multiplying them with 62, the number of pounds in a cubic foot, by which we obtain 27,297.36 pounds; this, multiplied with the hight (10), gives 272,973.6 foot-pounds, which, divided by 33,000, gives 8⅓ horse-power very nearly. An old-fashioned water wheel would utilize of this only about one-half, or 4 horse-power; an improved turbine, such as Poole & Hunt's Leffel turbine water wheel, would utilize more than 90 per cent, or 7½ horse-power at least.

(2473) Dead Black for Brass.—We have before described a method, which consists in forming a coating of the black oxid of copper on the surface; this being an adherent, dull black, is the best of all methods for this purpose. An improved recipe, and one now successfully used in France, is the following: Make a strong solution of nitrate of silver in one dish, and nitrate of copper in another; mix the two together, and plunge the brass into it; remove, and heat the brass evenly until the required degree of dead blackness is obtained.

(2474) Bluing Steel.—Dissolve 4 ounces of hyposulphite of soda in 1½ pints of water, and then add a solution of 1 ounce of acetate of lead in 1 ounce of water. Place your polished iron or steel objects in this solution, and boil until the blue coloring is satisfactory.

(2475) Speed of Saws.—The best speed for rotary wood saws is 150 feet per second, or 9,000 feet per minute, consequently a saw 12 inches in diameter—3 feet around the rim—should make 3,000 revolutions per minute; 24 inches in diameter, 1,500; 3 feet in diameter, 1,000; 4 feet in diameter, 750; 5 feet in diameter, 600. Shingle, and some other saws, either riveted to a cast-iron collar or very thick at the center and thin at the rim, may be run with safety at a greater speed.

(2476) Mounting Lenses.—This is done by what is called "spinning." By this process also all kinds of glass, china, and wood knobs are attached to their brass fittings. The brass mounting is first formed like a flat saucer, into which the glass or other article is easily inserted. The articles being fixed in a lathe and set in motion, the workman applies to the thin edges of the brass saucer socket a certain amount of pressure by means of a burnisher; this pressure has the effect of turning over the edges of the socket upon the glass. Optical lenses are often mounted in this way, but in the more expensive instruments they are secured by a screw ring. Brass locks, and shutter and other knobs, are generally cast, each in two hollow pieces, and then spun together, so as to form one perfect article.

(2477) The Fastest Railroad Time.—The fastest time made by railroads is in England, where the express trains between London and Dover run regularly at a speed of 50 miles per hour. Next is in Belgium, where the express trains make regularly 42 miles. In France and Germany they run at less than 40 miles. Our fastest express trains only occasionally reach such velocities.

THE MANUFACTURER AND BUILDER.

Vol. XI.—No. 10. OCTOBER, 1879. ELEVENTH YEAR.

Patent Lawsuit Respecting Cornice Machines.

In 1868 a United States patent was granted to Mr. Valentine Fischer, for details in a machine constructed by him, for bending sheet-iron in regular shapes, for the purpose of making moldings and cornices. It consists of elongated dies, as long as the longest plate to be bent, set in a strong frame of wood, the lower die stationary and the upper one movable, so arranged as to be pressed down by a series of toggle levers, their points being in a horizontal rod, by the movement of which they are spread or contracted, lowering or raising the upper die. This rod is moved in or out by means of a pinion working upon a thread. The claims of Mr. Fischer are seven in number, but his fourth claim, "arranging the female die G above the male die E, for the purpose of keeping the female die clear," is the only claim said to be infringed upon. See Fig. 2.

In the meantime, Mr. George Hayes, the well-known manufacturer of skylights at 71 Eighth avenue, this city, built a machine of the same style as had been manufactured in England for many years prior to the date of the patent. Two or more such machines are now being used in this city which were imported from England, and embody the principles above named. The first machine of this general kind used in this country was imported from England in 1867, one year prior to the date of the patent. It was purchased by a Mr. Wilson, of New York, now out of business, and afterward passed into the possession of Messrs. Ackerman & Borkel, and is now in use in this city in the shop of Mr. John Borkel.

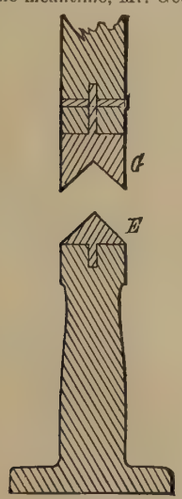


Fig. 2.

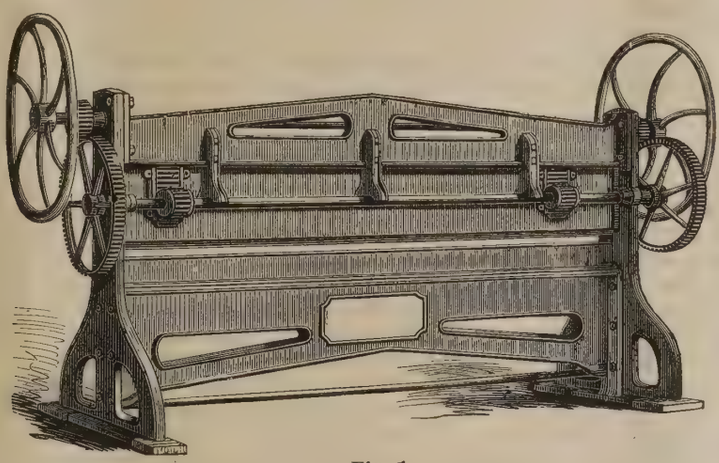


Fig. 1.

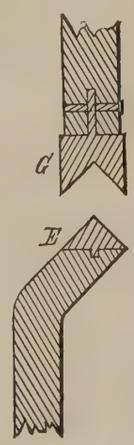


Fig. 3.

It was in 1870 that Mr. Hayes got up the machine represented in Fig. 1, to suit the requirements of his business, and without any regard to invention, he recognizing all that he employed as old principles.

Below the cross-head of the machine is a reciprocating carriage carrying the upper die, which has a vertical motion, being moved and controlled by the large hand-wheels shown at the ends of the machine The dies are used in parts, one die being fastened to the bed-plate and the other the to movable head, and forms and bends are made by clamping or pressing the metal between these dies. By examinating of the sections it will be seen that the upper die is keyed to the head and the lower die is attached to the bed-plate by means of dowels. In the use of the machine upon full length moldings three operators are required, two of them to hold and adjust the sheet of iron, and the third to revolve the wheel which moves the head of the machine. The operation is, therefore, somewhat slow, and in point of labor quite expensive, yet the machine is so powerful and the shape imparted to the metal so uniform throughout, that in a measure these objections are overcome.

Fig. 2. represents a cross section of a pair of the dies used in this machine, which are fastened to the same by suitable keys. Fig. 3 represents a cross section of a somewhat different shape, having a concavity in the front side of the bed below the edge of the lower die, so as to accommodate projecting ribs produced in the process of making moldings in sheet-iron, which is of great importance.

From the patterns made by Mr. Hayes at this time, machines were constructed for his branch establishments at Chicago, Boston and San Francisco. His business being the manufacture of skylights, the machine, as constructed by him, was calculated particularly for use upon that line of work. It was discovered, however, by some of his neighbors, after he get to using the machine, that it possessed features desirable for use in cornice work, and accordingly, a number of the machines were built from Mr. Hayes' pattern for cornice makers. There are at present a total of about 16 or 17 machines of the Hayes pattern in use.

Very soon after the issue of his patent Mr. Fischer commenced suit against Wilson, whom we have mentioned above as having imported a machine of similar construction from England in 1867, and this suit in turn was transferred by sale of the machine to Messrs. Ackerman and Borkel. It was allowed to drag its slow course through the courts until some time in last April, when a decision was reached, Judge Blatchford being upon the bench. Suit was commenced by Mr. Fischer under the patent against Mr. Hayes in 1870, which suit was practically abandoned, and no decision in the case has been reached up to the present time. Upon obtaining the decision of Judge Blatchford, in the suit of Fischer *vs.* Wilson, Mr. Hayes and others were enjoined by Fischer against using their machines, and suit was instituted. At this juncture Mr. John Nicholson, a prominent cornice manufacturer of this city and who owns an imported machine, and Mr. Borkel, the final successor of Wilson, took out licenses under the Fischer patent and left Mr. Hayes virtually to fight the case alone. He at once made such changes in his machine as not to interfere with the Fischer claims, and as the case now stands argument is being made before a referee, whether Mr. Hayes should not be declared in contempt of court for persisting in the use of dies arranged with the projecting die below and the hollow die above. Mr. Hayes claims, and with show of reason we admit, that if the patent laws of the United States are such that the Fischer patent of itself is a valid one—that if the fact of such machines being in use in other countries, although not there patented, and although not published in books or periodicals, does not render the Fischer patent inoperative—it still goes too far in this fourth claim relating to the arrangement of the dies. Mr. Hayes claims that this device is old—almost as old as the art of working metals; that it is used in various connections, from the blacksmith's swedge up to certain machines made for corrugating sheet metal. Certain experts assert that it is a device which they used in the construction of machines long before the Fischer patent was granted, and which they did not attempt to patent in connection with other features, because it was known to be old at that time. Mr. Hayes has in his possession several of these machines and dies, which were in use many years prior to the date of Fischer's patent, and which he intends using in evidence. Upon the strength of this opinion, backed by the assertions of experts, Mr. Hayes proceeds in his fight of resisting the patent.

Exhibition of Tin, Tinware, Etc.—The association of tinsmiths and workmen in sheet-metal in general, in Neurenberg, Germany, organized an exhibition of tin, tinware and tools for working sheet-metal, which has just closed, and is reported to have been especially interesting. The jury awarded the large silver medal to Mr. Wilmart, of Belgium, for superior sheet-tin manufactured by him; so that it appears that the best sheet-tin is now made in that country.

The Manufacturer and Builder.

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Vol. XI. No. 10. ELEVENTH YEAR.

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The Problem of Solar Radiation.

One of the most stupendous problems staring the modern physicist in the face, is to explain how it is possible that the solar energy, which reaches us in the form of heat, can pass through millions of miles of that space through which the earth is being driven by its momentum, and in which space a most intense cold prevails.

If the earth had no heat of its own, this solar radiation would be incompetent to heat its surface to such a degree as to make organic life possible. This is proved by the perpetual snow on high mountain tops, which lose so much more by radiation than the valleys and plains that the interior heat of the earth cannot keep them at a temperature above 32° Fah. It is proved by the low temperature prevailing on the surface of the moon, which, being so much smaller than the earth and possessing little or no atmosphere, has long since lost the heat required for organic life. It is also proved by the fact that the mean temperature of the ground is always a little higher than that of the air, and increases with the depth, and finally, the 200 active volcanoes on the earth's surface, with the numberless hot springs, are the most potent proofs that the earth's interior must be very hot, and loses this heat only very gradually.

That this terrestrial heat is at the present stage of the earth's existence utterly incapable of developing organic life, is proved by the low temperature prevailing at the poles, where the formation of ice is due to the deficiency of solar heat, while on the mountain tops it is due to the insufficiency of terrestrial heat.

Still, however evident and clear is the action of this terrestrial heat, the transmission of the solar heat through millions of miles of a medium so attenuated as to surpass the best vacuum we can produce in our air pumps, is, at the present condition of our knowledge, an apparently insoluble puzzle, and has become more so since the discovery that heat is merely a mode of motion, and, like light, a mere vibration of material molecules. The question is, how can the motion of that interplanetary medium, which is apparently a mere nothingness, evolve through such enormous distances the stupendous energy on our terrestrial surface, which energy is consumed in the raising of water into clouds, and its return as rain and water-power; it is consumed in raising winds and storms, in evolving vegetable and animal life, in short, in performing all the functions pertaining to a live planet. How is this stupendous energy, or latent motion, transmitted through a mere nothing? That is the question.

Association for the Diffusion of Science.

On page 194 of our September number, we referred to the Netherlands Society for the Public Good, and will now add a few particulars, the knowledge of which is necessary to understand the workings of this society, which for more than a century has exerted a most beneficial influence on the country which gave it birth.

The parties who founded this society were very properly of the opinion that "the public good" could be best promoted by the diffusion of useful scientific knowledge among all classes, especially among the working population, and therefore all the efforts of the society have been directed to this purpose. For this reason it might just as well be called, what it really is, an Association for the Diffusion of Science. For the accomplishment of this object, the society employs three different means:

First. The foundation in most all cities and large towns, of schools in which the standard of instruction is of a higher type than that given in the government public schools.

Second. Evening lectures, which the sub-sections of the society are obliged to organize in the locality of their operations.

Third. The publication of text-books for schools, and various other useful books for the working people, and youth in general.

1st. The schools are for the children of members of the association only; they are not entirely free, but require a nominal charge, as a large portion of the expenses are borne by the association as a whole. The instruction, notwithstanding given to both boys and girls, is of a technological tendency, it being considered necessary not to leave girls in ignorance of the methods which human ingenuity has devised to manufacture their clothes, construct their houses, prepare their food, etc. To each school a library is usually attached, for the use of the members of the association.

2d. The evening lectures vary greatly in different localities, and it must be confessed that in many places this is the weakest part of the labor. While in large cities the lectures are highly interesting and instructive, always relating to practical scientific subjects, in small towns, where the funds will not justify the engagement of learned lecturers, and the members volunteer by turns to occupy the rostrum, the lectures are often insignificant. If discussions after the lectures were introduced, as is often done in this country, some useful results might often be attained; but this is contrary to the custom of the country, it being considered impolite and as much out of place to discuss or even criticise the efforts of a lecturer after he has finished, as it would be in this country to criticise in the church a preacher after the close of his sermon.

3d. The publications are perhaps the most useful part of the workings of this society. It should be understood that it is a publication concern not instituted for any profit, as the constitution of the society wisely forbids this. A copy of each book printed is sent to every member of the society, and to the library usually attached to each school of the association. Each branch association, and every individual member, is entitled, at first cost, to as many copies as it is desired to distribute, and often a liberal use is made of this privilege, as the books treat on all the social questions, and the series forms a complete cyclopedia, not only of the practical useful arts and sciences, but also of social science, without however pretending to such a name. The subjects treated, and for which the texts are obtained by prize medals, relate to the questions of labor, wages, strikes, the value of peaceful industry, wealth by labor, domestic economy, temperance, virtue, sanitary precautions, the treatment of children, educational principles, the necessity of practical science, apprenticeship, etc. Often the useful parts of the publications are disguised by being clothed in the garb of an interesting story, so as to make them palatable to the general public. The books published by this association form, with its yearly reports and transactions, a library far exceeding a thousand volumes.

Humbug No. 4.—Prescott's New Use of the Divining Rod.

The divining rod (a remnant of the superstitions of bygone ages) is a long and slender forked stick, preferable cut from a hazel tree, but one from an apple or elm will answer. The two forks are grasped firmly, one in each hand, leaving the portion where the forks unite pointing obliquely upward. While held in this manner at a distance of from one to two feet above the ground, the operator walks to and fro over the ground to be explored; when finally he perceives that the end directed upward begins to point downward, he stops and says that this is the place to dig a well and certainly to find water; or the place to sink a shaft and find gold or silver; or that here a treasure has been buried, etc., according to the circumstances or the desires of the parties employing the diviner, and paying him for his services.

To these supposed wonderful powers of the divining rod, Messrs. George S. and A. R. Prescott, of Merrimac, Mass., have added another—that of detecting what they call "electrical earth currents." They have announced as a discovery of theirs that where there are such currents there is danger of attracting lightning, and where there are no such currents there is no danger of this, consequently in the first case lightning

rods are required, while in the second case they are not. In order to detect these currents, they use the divining rod, which indicates them as well as it does water, gold, silver, hidden treasures, and what not.

The local papers in the neighborhood where the Prescotts reside give accounts of the experiments made by them, stating that when they found an earth current, an old inhabitant was also found who declared that "lightning once struck within four feet, more or less, of this point." The confidence they have inspired among the ignorant of their neighborhood is so great that they have obtained the monopoly of erecting lightning rods there, and are keeping out every other "lightning rod man."

Among the believers in their special powers, are treasurers and presidents of banks, clergymen, city engineers, and, we are sorry to say, even teachers of schools and academies, who have been witnesses of their use of the rod. It must be stated that the rod in other hands does no good, as the Messrs. Prescott claim to be very sensitive to electrical influences, and to have most wonderfully sensitive organizations; they claim that they possess the "electric sense," unknown to the multitude, and even to the skeptic scientists, and can almost smell and taste the electricity beneath their feet. This is very much in the style of the false pretensions of Baron von Reichenbach, whose statements are adopted by many as gospel truths, without even submitting them to any test. The same has been the case with the divining rod, in which hundreds have believed for centuries, and the two Prescotts, taking advantage of the superstitious tendencies of their neighbors, profit by them, as in this way they can earn more money, and this much easier than they were able to do before at their legitimate business, which is farming. They do not lay claim to any knowledge of science, and have made this discovery without understanding anything at all about electricity.

Now, in regard to facts. There is no doubt that some parts of the earth's surface are frequently struck by lightning, while other parts are comparatively free. This, however, does not depend upon any hypothetical earth currents, which the galvanometer would certainly detect in a reliable manner, but upon the greater or lesser conductivity of the earth. Thus, we know of church spires having been struck twenty times within a century, but this for the simple reason that the ground upon which they stood was iron ore, and a good conductor. Pilot Knob, in Missouri, a mass of almost metallic iron, is frequently struck, while granite rocks consisting of the isolating quartz, felspar and mica remain intact. As water is a good conductor, any building standing over moist ground is safer for being provided with a lightning rod, well connected with the moist earth below; and it is evident that such common sense considerations are far more reliable in settling the question of the advisability of erecting lightning rods than the humbug divining rod and the false pretenses of impostors.

New York City the Greatest Watering-Place.

Some twenty years ago, and even less than that, Coney Island remained as neglected as it had been since the creation, and the lapse of more than two centuries were not sufficient to make New Yorkers alive to the advantages of such a magnificent sea-beach near their very door, while they travelled fifty, a hundred, or more miles to the stony, steep, dangerous and uncomfortable beach of Long Branch, or to the limited and expensive accommodations offered by Newport.

On our first visit to Coney Island twenty-five years ago, we were both astonished and indignant that such a fine sea-beach, which has no superior in all Europe, should be ignored by the better classes of New York city, and be left entirely in the hands of loafers and gamblers, besides this being studded with low drinking saloons, and having the most wretched accommodations for bathers. However, the little bathing houses at Long Branch were no better, and, if possible, even worse than the dilapidated shanties at Coney Island; and it was another matter for our astonishment that the wealthy people who frequented that fashionable watering-place should be satisfied with such a wretched state of affairs.

At length the eyes of New York people were opened to what they should have seen long before—the natural advantages of Coney Island beach as a watering resort. The main reason of this was the Kings county survey, originated in 1869, and resulting in a plan of streets and avenues in that part of Brooklyn adjacent to Coney Island. In 1873 the principal ones were commenced, especially those leading from Brooklyn to the island, and some directly over the island to the ocean; Ocean avenue, Ocean Parkway, Gravesend, Twenty-second street, Fort Hamilton and Fourth avenues, Forty-ninth, Sixtieth and Eighty-sixth streets, with others, were laid out and handsomely improved. Their construction was soon followed by a railroad, and then improvements began on a scale so large and in so short a time, that no locality in the world can point to a parallel case, where, in the short space of four years, a neglected, barren, lonely shore was transformed into a real fairyland. In fact, no description can give any idea of the splendor of that coast, especially on a summer's night, miles of beach being studded with colossal hotels, bathing pavilions, and restaurants, all connected together either by railroads or stage lines, and also by splendidly gravelled, macadamized, asphalt or wooden walks. Every prominent place has a good orchestra, giving afternoon and evening concerts; in the evening thousands of gas-lights illuminate the coast, varied by electric lights, and frequently great exhibitions of fire-works, and this all free to the public, the only profit being made by the restaurants, bars, and means of conveyance. When in full blast on a summer's night, the whole gives to the visitor the impression of a festival for some grand victory. The sight of the bathers in the surf, illuminated by an electric light shining over them, is not the least attractive for the looker-on, while the benefit to the public health, by the combined effects of the sea bath and the fresh breeze cannot be overestimated, and undoubtedly New York owes a great deal of the favorable condition of the public health to the praiseworthy efforts of her capitalists in making Coney Island what it has become.

The amount of money spent during the four years in which this almost magical transformation has taken place, amounts, for the railroads alone, to $5,000,000, for which sum the following assets can be shown: In 1876 the Bay Ridge railway, to Jamaica, was built from the bay to Bath Junction; the Prospect Park railway was also built in the same year; in 1877, the Bay Ridge and the Manhattan Beach railroad was completed to the island from the junction and from Greenpoint, and the Sea Beach road built from the junction to the island; in 1878, the Brighton Beach was built; in 1879, the Sea Beach railroad has been completed to the bay, and the New York road to the West End and the iron pier, making in all six channels of public access to the island. They have, on various occasions during the past season, carried over 100,000 persons both ways per day, and can easily double this quota. It is not an uncommon event for one of either the splendid hotels of the four new lines to dine over 6,000 per day, and the inducement to outlay is so great that Coney Island is destined to out-rank in advantages, accommodations and patronage every other sea-side resort on the coast.

The Bay Ridge railroad was built on the standard State gauge, and narrowed by Mr. Corbin to 3 feet. It was located on the Bergen farm, in the only valley which crosses the Long Island ridge for many miles, and even then required an excavation on the first mile and a half of about 260,000 yards, in a gravel formation, to secure a freight road grade of one per cent from the bay, the road being intended to do the heavy freight work of the island. The boat-landing is a solid 24-foot crib, 27 feet high, filled with stone and backfilled with gravel, so as to form a permanent work. The line passes under three avenues, by substantial brick and stone tunnels, 25 feet wide and about 16 feet high, two 80 feet long, and one (at Fourth avenue, built in a cut of 43 feet), 188 feet long. Another tunnel, under the Ocean Parkway, of the same class, 210 feet long, was unfortunately built 22 feet wide, after the gauge was reduced. The cost of the dock, road-bed and superstructure (double-tracked) to the junction, was about $132,000.

The Sea Beach road, organized in 1876, by Messrs. Backhouse, McCormack and McElroy, of the Bay Ridge road, was intended to furnish a branch to Coney Island from the junction 3¼ miles long, and a contract for trackage over the Bay Ridge to the bay was made with Mr. Corbin, when the line changed hands. After the branch was built, and the United States Exposition building brought on from Philadelphia and erected, the Bay Ridge road refused to fulfill this contract, and a new line to the water has been built, parallel with it for 2¼ miles, with a dock and slip, on the north side, at the foot of Sixty-fifth street. This work was delayed, from litigation and other causes, until about April 20th, when the contractors, Beard & Hanlin, broke ground. Confined to a long, deep cut for a mile, they yet excavated 100,000 yards, so as to have the road-bed ready for the track by the 8th of June, and the road was opened to use July 18th. The construction of a bridge over the Manhattan Beach road, about 4¼ miles from the bay, made a ruling grade of one and a half per cent in that location, and materially reduced the quantity of work as compared with the Bay Ridge, the amount being about 130,000 yards.

The total length of the line is 6 miles, requiring about 15 to 17 minutes running time, so that only 40 minutes are required from the Battery (New York) landing to the Sea Beach Palace. Any railroad man will understand at a glance that with a moderate equipment, a double track line of this length is able to keep a fleet of boats busy in its supply, and that a line located on the bay has so many points from which to draw passengers, the movement of 15,000 or 20,000 persons per day is a moderate demand on its resources. It has a Brooklyn connection at Third avenue, whose grade, quickness and cheapness, make it a successful competitor for the population of that vast city.

The Palace at the beach is an enormous structure in area, with a front toward the sea of 360 feet, and on the east side of 400 feet. The main dining-room is 360 by 120 feet, with a large dining-wing, for which a kitchen 60 feet square has been carefully fitted up, with abundant store-rooms and other conveniences. The surrounding piazza is about 840 feet long by 25 feet wide on the lower floor, while the upper promenade is 43 feet wide, covering a splendid marine outlook. Seen from the beach, with its grand dome, the architectural effect is fine, and the architect, S. Curtiss, Esq., has displayed great taste and skill in the external and internal arrangement and ornamentation of the buildings.

The grounds of the company cover about 20 acres, and join the Prospect Park road grounds on one side and the Brooklyn & Bath on the other.

The operation of a narrow and standard gauge track, with respective grades of one and one and a half per cent, parallel for 2¼ miles, furnishes an interesting daily comment on the much-discussed gauge question; the advantages of the standard gauge being apparent in engine power and speed, and other important respects, while the differences in outlay are equally important. The practical issues determine questions of this class better than text-books and theories, and the error in reducing the Bay Ridge gauge is a matter of daily demonstration.

Disinfecting Memphis.

We see that at last a thing is being done which should have been done long ago, namely, disinfecting the plague stricken city of Memphis. It is reported that the work of disinfection is progressing under the supervision of the National Board of Health. On the 1st of October 8,500 premises and 7,000 vaults had

been disinfected. When the disinfection of all the premises in and around Memphis has been completed, all those in which yellow fever has occurred will receive a second thorough treatment. This work is being done by the National and State boards, with the understanding that as soon as the weather is cold enough to make it safe, all vaults for refuse and cesspolls are to be emptied, filled up with dry earth, and sewers and earth drains substituted. The amount of copperas used in disinfecting was 170,105 pounds. About 160,000 pounds of this have been distributed in the form of solution, or about 85,000 gallons; 9,000 barrels of lime, 40 barrels of sulphur, 1,215 pounds of sulphate of zinc, 15 barrels of carbolic acid, and 120 gallons of zinc iron were also consumed.

New Combination Fret Saw.

The continually increasing demand for tools that can be adapted for more than one purpose, has, by the ingenuity of Mr. Henry L. Beach, of Montrose, Susquehanna county, Pa., resulted in the combination saw and turning lathe represented in the two adjoined engravings, of which Fig. 1 represents the machine with its bed ready for sawing, and Fig. 2 the same machine, with the bed removed and the lathe placed in position, ready for turning, drilling, grinding, or any other purpose for which a lathe is adapted.

The manufacturer wishes it to be understood that this is not an unreliable machine that will give unsatisfactory results, unavoidably connected with the cheap machines of this class with which the market is at present overrun; it is a machine that will last a lifetime, and give satisfaction not only to a boy, but to a workman also.

The arms of the saw have their rear ends bolted to small cast pieces, circular in form; the exact centers of these circles are the points where the saw is attached. The cast pieces project back of the circles and are connected by the bar D, Fig. 1; the bar P is hinged to an upright piece at its center, and as the saw moves up and down the circular portions of the cast pieces rock against the straight edge, causing the saw to move in a straight perpendicular line. By the use of an eccentric lever any degree of strain can be given to the saw that may be desired. The air pump H gives a positive blast which passes through the center of the arm (it being hollow) and escapes through the brass tube at F. Too much stress cannot be laid upon the principle which gives the saw a perfectly straight up-and-down motion and the ease with which any amount of tension may be imparted to the saw by means of the eccentric lever.

There are no springs used in the construction of of this machine. In all other machines using two arms, the saw is required to move the upper arm, subjecting the saw to great strain and oftentimes causing it to break. In this machine the upper arm is permanently connected to the lower, so that the power acts equally on both. This saw will cut horn, ivory, pearl, shell, gold, brass, and all kinds of wood up to 1¼ inches thick.

The lathe attachment (Fig. 2) is well fitted; both centers have two bearings. It runs without jar, and will do excellent work; its capacity is 11 inches long and 4 inches diameter, and has a speed of 2,500 revolutions per minute. It has a set of four steel chisels made from Jessop's best imported English steel, by the Providence Tool Company, expressly for this machine. The change can be made from the saw to the lathe in one minute.

The advantages of this machine are: It is very light running, and built almost wholly of iron and steel, stands firmly upon the floor, and does not require to be fastened down. The saw has no backward or forward motion; all other machines using two arms hung upon a fixed point at the rear, must of necessity give to the forward ends of the arms, where the saw is attached, a circular motion, causing the saw to vibrate back and forth; while in this machine the peculiar construction of the arms and their attachment to the frame, entirely overcomes this difficulty, and a perfectly straight line is produced on the saw, which is of the utmost importance, and without which it is impossible to do a fine piece of inlaying or any very fine work with any degree of satisfaction. It has a tilting table bed which can be thrown on any angle, for cutting bevels and for inlaying; this is a very important feature, and without which no machine can be complete. Instead of the ordinary round belt, a ¾-inch flat belt is used for running both the saw and the lathe, which experience proves is decidedly preferable, while provision is made for taking up all stretch of the belt without re-lacing. The arm A can be thrown up, as in Fig. 2, to facilitate the removal and replacing of the work over the saw, which is very convenient in any class of work. All other machines giving a straight motion to the saw, use a slide or bar, which is supported by the upper part of the frame, extending over the table. Where this is the case, a great deal of time is required and no little trouble experienced in changing the saw. In this machine the difficulty is entirely overcome, as there is nothing above the table to interfere. In cutting ordinary work, where the quantity turned out in a given time is of more importance than the quality, the upper arm A can be thrown forward, giving any desired rake to the saw and causing it to cut twice as fast. Throwing the lever G forward, the saw is placed in the clamps loosely and without strain, so that even a lady or child can put the saw in with perfect ease; then by throwing up the lever, (which requires but a second), any amount of strain can be had, according to the size of the saw.

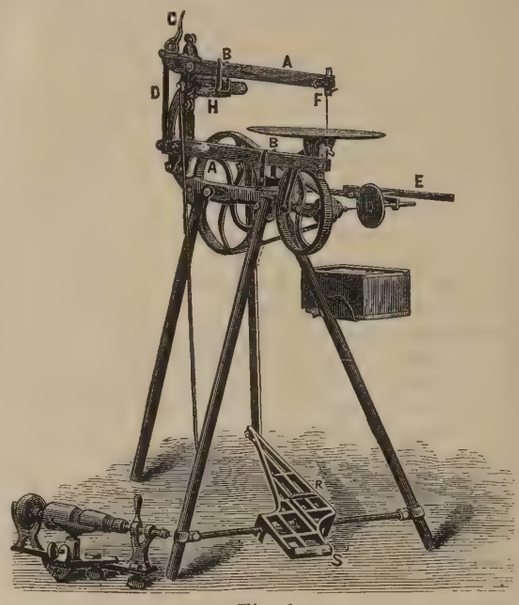


Fig. 1.

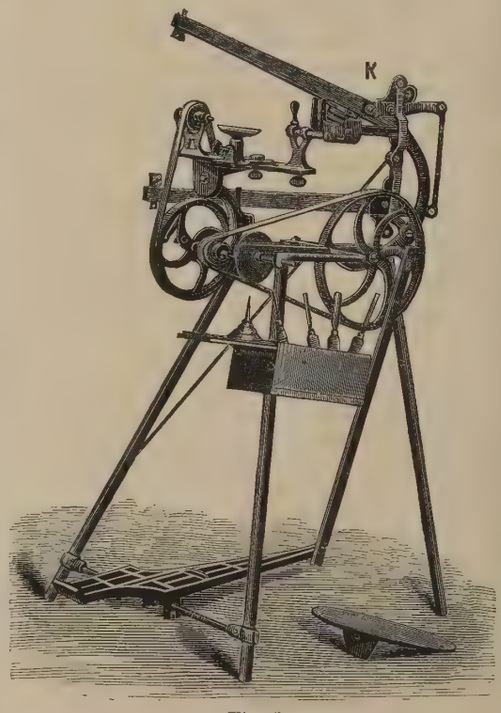


Fig. 2.

The pump H is made of leather, air tight, and is attached to the upper arm; when the machine is running it rests upon an iron support, while the motion of the arm downward compresses it, forcing the air through the center of the arm to the forward end, where it is conducted to the iron bed, instantly removing all sawdust from the work. It is the most compact and effective blower in use.

This machine gives more than 20 inches swing between saw and frame, which is from 2 to 8 inches greater than other machines; the advantage of this all scroll sawyers will appreciate, as it gives ample room for turning the largest brackets.

The drilling attachment E, placed at the right of the machine, is always ready for use. It has an iron bed attached to a shaft which slides in iron guide ways for supporting the work while being drilled. This arrangement enables one to pierce the work square through much more rapidly than with any upright drill, as it runs with the whole power of the machine, and is entirely out of the way when manipulating work around the saw. Where a large number of holes are required, the saw can be detached in one second, leaving nothing but the drill to be run.

Both arms play between the adjustable brackets B B, which entirely prevents any side vibration of the saw. The stand for the frame is made of tubular wrought iron, combining great strength with little weight. The arms A A are made of the best ash timber; the tool chest and long pitman of cherry, and the short pitman of second-growth hickory, all finished in oil, while the whole machine is handsome in design, perfect in movement, and will execute as fine work as the most expensive machine made.

Bungling with the Steam Catamaran.

It appears that Mr. Merritt, of Poughkeepsie, N. Y., who conceived the idea of having an experimental steam catamaran built, (see pages 202 of our September number and 227 of this issue), has, by two most stupid blunders, spoiled the good idea of using two sharp hulls connected by a platform, each hull provided with a steam engine working paddle wheels outside and between them.

The first blunder was in taking, instead of an ordinary paddle wheel, such as is used on all our river and ocean steamers, and by long experience proved to be good enough, a new patent feathering arrangement, which, when tried, would not work at all. The second blunder was in connecting the two hulls, not only by a platform above water, but also the keels by cross beams under water, forgetting that the resistance of such beams under water is something enormous, especially as they are very apt to catch up and carry along large amounts of eel grass.

After trying the feathered wheels and finding that the craft would scarcely move at all, he fastened the buckets of the feathering wheels, and the boat then made some five miles an hour. Now he is going to remove the cross beams under water, and may perhaps double that velocity. Very likely these are not the only defects; a man who commits such glaring mistakes, has no doubt made others, because they are a confession of ignorance, and how much more ignorance has been displayed in the form of the hulls, in the engines, in the boilers, in the furnaces, etc., has not yet been shown by reports.

This is an illustration of the danger that people run when they spend money on things in regard to which they do not possess sufficient information.

Standard Hydraulic Elevators.

The experience of recent years has demonstrated that in all cities blessed with water-works, and where the water pressure is sufficient, it is not necessary to introduce steam engines to raise the elevators establishing connection between the different stories of warehouses, hotels, and other buildings where they are desirable. The water pressure is found to be entirely adequate for this work, thus dispensing with elevated tanks, steam engines, steam boilers, and engineers and firemen.

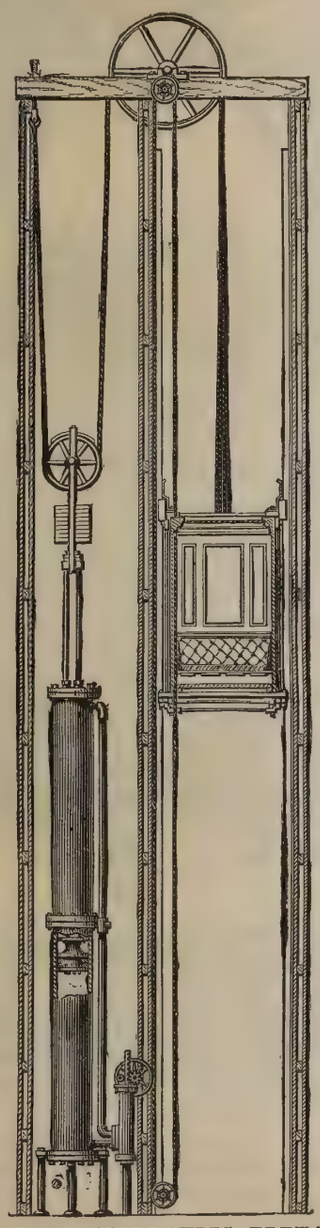
In the adjoined sketch we represent the outlines of one of the improved elevators of this class, as at present manufactured by the firm of Otis Brothers & Co., of 348 Broadway, New York. It is known as the Hale Standard Hydraulic Elevator, and being easily managed by any lady or youth, and not subject to any of the dangers incident to many other kinds of elevators, it has risen into great public favor. Several years' experience in this business has enabled the manufacturers to overcome all difficulties and objections, and to present to the public a machine of the very simplest and safest construction, which has been thoroughly tested by long use. Every probability and possibility of accident has been guarded against. All parts of the machine are made not only strong enough for the work required, but many times stronger than extreme prudence would dictate. To make these machines safe neither pains nor expense has been spared. Where other manufacturers use one or two ropes, in this machine four or six are employed, while all other work is made strong in proportion.

Experience has proved that the upright cylinder is far preferable to the horizontal, because the wear is alike on all sides, while in the horizontal it is always on the bottom. By discharging the water when ascendingandutilizing the pressure of the atmosphere, down to the level of the discharge, the maximum of power is secured, and also the water in the cylinder used as a brake in lowering the car. It is claimed that these advantages enable these elevators to do more work with a given pressure than any other machine in the market.

The elevator here represented is the result of many years' study and experiment of the inventor in his efforts to produce an elevator simple, substantial, safe and cheap. The practical mechanic will see at a glance that it has been constructed so as to obtain the maximum power of the water with the least possible friction, and in a simple and effective way. The motive power for its operation is obtained by using the pressure and weight of water from a tank in the upper story of a building, or directly from the city mains, as may be feasible. In addition to the pressure and weight upon the top of the piston, the normal pressure of the atmosphere is utilized below. These forces are applied to raise the carriage, by drawing the water from the cylinder below the piston. The carriage is secured to the piston by several ropes, which pass up over a fixed pulley wheel, thence to a weighted gin block, and their standing parts are secured above as shown. The weight of the block, together with the piston, constitute a counterpoise for the carriage, while the piston is attached to the gin block and traverses the cylinder. When the carriage is at the lowest point of its course, the piston is at the upper end of the cylinder. To cause the carriage to rise, the valve rope passing through it is pulled, thus opening a valve which admits water through a pipe to the top of the piston, and at the same time opens an exit pipe for the water already in the cylinder below the piston.

Since the weight of the carriage itself is compensated for by the counterpoise already mentioned, the resistance to be overcome reduces itself to the load added, *plus* the inertia of the various parts. Against this there is, first, the weight of the air (15 pounds per square inch) above the piston—this is obviously gained through the escape of the water below, the cylinder being always full; second, the absolute weight of the water itself acting on said piston; and, third, as a variable force, dependent upon outside circumstances, the pressure of water which may exist in city mains or may be due to a difference of level between the bottom of the cylinder and a tank located in the upper story of the building. The result of this condition is necessarily the descent of the piston and the elevation of the carriage, the water below the piston meanwhile escaping into the sewer, or being led into a tank, from which it may be raised by any means to the tank in the upper story, and so be used over again if this is desirable.

To lower the carriage no outside power is called into use; the valve rope is pulled so as to set the valve in the opposite direction, and thus allow one column to balance the other, and the water above the piston to pass out of the cylinder through a circulating pipe and



STANDARD HYDRAULIC ELEVATOR.

back into it again under the piston, the piston itself ascending in the meantime, being moved by the greater weight of the carriage. The carriage thus sinks noiselessly and smoothly, its speed regulated by the operator in the opening or closing of the valve, and outside of his control by the size of the pipe. Any speed desired may be obtained, and a certain range is allowed the operator, but each machine is so set that the maximum speed desired by the proprietor cannot be exceeded. It stops automatically at top and bottom, and may be called from one floor to another by pulling the operating rope at the door where it is wanted.

The cylinder is made of cast iron about ¾ of an inch thick, and is bored out true and smooth its whole length; all moving shafts are of steel, while all other parts, except the car, are of iron. It will thus be seen that the whole machine is a marvel of simplicity, necessarily very durable, and requiring but little care. If city pressure is used, no engineer or skilled attendant is needed, but any one who will oil the bearings may operate it.

According to this system, passenger and freight machines of all sizes are made adapted to lift any load required. It is evident that the maximum load which such elevators can carry depends on the pressure and the size of the cylinder, hence the latter is determined by the circumstances given, which are: 1st, whether passengers or freight are to be raised; 2d, maximum load; 3d, hight to be lifted; 4th, what pressure of water per square inch can be obtained, or from what elevation; and, 5th, size of well room.

These machines are adapted to all hoisting, whether much or little is required, and are claimed to be more economical than any other hydraulic elevators (both in first outlay and cost of running) for every class of work. Where a moderate amount of work is required daily the saving is very great, while they are equally well adapted to warehouses, stores, private houses, public buildings, and hotels.

We will only add to the above that we have before us numerous testimonials from parties who have these elevators in use, and even a letter from the Secretary of the Treasury, stating that after thorough inspection, they have been adopted for several of the United States Custom Houses.

Tubular Piles

The *Scientific American* describes a novel and ingenious system of constructing and driving piles which has of late been introduced into practice by Messrs. Le Grand & Sutcliff, of London, artesian well engineers. It involves a considerable departure from ordinary practice, inasmuch as the piles are driven internally and at the bottom, instead of externally and at the top. The invention originated with the senior member of the firm, while the credit of a portion of the application of the principle is due to the junior member. The piles, says *Engineering*, are tubular, and can be made of either wrought or cast iron, and the thickness of the metal can be proportioned to suit the varying circumstances of construction. The lower end of the pile is made solid and pointed, and is generally of wrought iron and steel-tipped. The piles are made in sections, which are screwed together by strong steel sockets or joint covers, which are barrel-shaped on the outside in order to diminish friction when being driven. The method of driving these piles is as simple as it is novel. Instead of the blows being delivered on the head of the pile, the driving force is expended just where it is wanted, namely, at the point. This result is attained by using an elongated cylindrical driving weight, which travels easily inside the tube. The weight is raised by means of rope or rods, and is allowed to fall on the flat head of the solid point, the pile thus forming its own guide for the driving weight. The effect of each blow is to drag rather than to drive the pile down. The point is swelled, and of sufficient diameter to effect a clearance for the joint covers, which have to follow it down. This pile fractures and passes through minor obstructions. The system commends itself for its simplicity.

American Horse Cars on London Tramways.—The firm of Stephenson & Co., of New York city, who make car building a specialty, are building for the London street railways the short one-horse cars, sometimes called "match-box" and "bob-tail" cars. They have the American style of pay-boxes, iron horse-guards at the dash-boards, and are finely finished, with upholstered seats. The excellence of our hard woods enables us to build these cars much lighter than can be done in England. The same firm has already shipped fifty two-horse cars for the street railway in South London.

Bolt-Cutting Machinery.

Among the special machines built for an exclusive purpose are those intended for cutting screw bolts; they were introduced in machine shops many years ago, but recently important improvements have been applied to them, as well in those worked by hand as in those operated by power. Our adjoined engravings represent two of these machines, Fig. 1 a hand bolt-cutter, and Fig. 2 a power bolt-cutter. They are both of the most approved kind, and are manufactured by the Pratt & Whitney Co., of Hartford, Conn. Fig. 1 is intended to cut ½ to 1½-inch bolts, and ⅛ to 2-inch pipe. The crank and socket are used on the stud of a small gear to cut ⅞-inch and larger bolts, and upon the spindle of the machine to cut ¾-inch and smaller bolts, and to back the die quickly off from large bolts after cutting, the spindle and the die revolving in the direction that the crank is turned. Threads may be cut a length of 18 inches as the machine is usually constructed. Nine taps and dies are furnished with the machine to cut threads of the following sizes: ½, 13; ⅝, 11; ¾, 10; ⅞, 9; 1, 8; 1⅛, 7; 1¼, 7; 1⅜, 6; 1½ inches, 6. They are represented in the engraving lying under the machine. The weight of the machine, with tap chuck, 9 dies and taps, is about 350 pounds.

A machine of this size is peculiarly adapted for shipsmiths, miners and bridge repairers; other sizes are made, such as those cutting from ¼ to ¾-inch bolts, designed especially for carriage shops, mills, and other concerns where bolts of these sizes, staples, braces, and other bent and crooked pieces have often to be cut. Small machines of this kind, adapted for being screwed to a table, weigh, with 7 dies and taps, about 100 pounds. An intermediate size is also made.

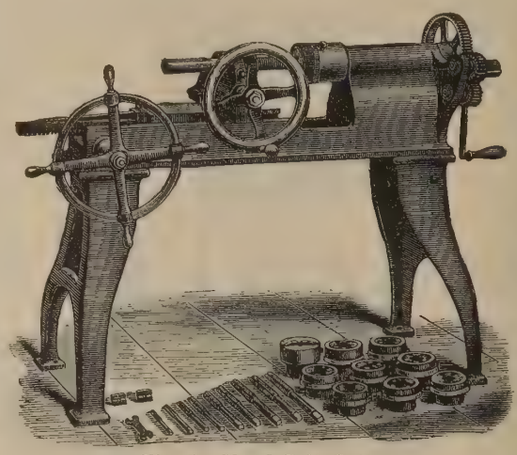


Fig. 1.—Hand Bolt-Cutter.

Larger sizes are best driven by power. Such a one is represented in Fig. 2, with its driving pulleys and counter shafting seen in the engraving below, on the floor. This machine has a cylinder that may be revolved at will, and secured in position by a spring bolt, holding on its periphery seven dies, either one of which may be presented instantly to the bolt to be cut, and carried forward by a crank, pinion and rack. The cylinder also holds a collet, adapted for recessed plates, to receive square and hexagonal nuts of different sizes for tapping purposes. This collet is secured and removed readily, as are also the dies. The revolving spindle is hollow, to receive bolts of any length, and, by removing the collet opposite the one that is at work, allowing the bolts to pass through the head, the thread may be cut to any distance required. The spindle is furnished with a chuck for holding the bolt, or the tap, and is driven by a cone pulley for a 3-inch belt. The chips and oil are caught in the bed, the oil draining free from the chips through a strainer into a receiver, from which it may be drawn to be again used.

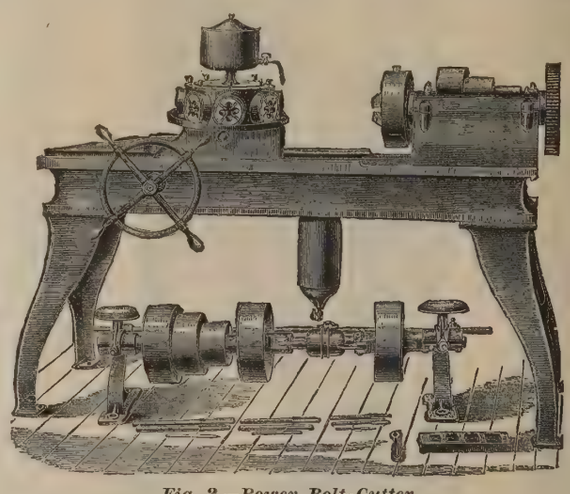


Fig. 2.—Power Bolt-Cutter.

The facility with which bolts of different sizes can be threaded (seven bolts of as many sizes almost as quickly as the same number of one size), renders this style of machine very serviceable and convenient in car shops, and wherever the number of bolts to be cut at a time is small, changes of size frequent, or men carry blanks to a bolt-cutter and wait to be served.

In addition to ordinary bolt-cutting, the machine may be fitted with special tools for finishing work by successive operations before removal from the chuck, as is done on revolving head screw and drilling machines, such as pointing, turning, squaring under head, and threading forged bolts, by use of hollow mills, box-tools, and dies.

Seven taps and dies are furnished with the machine for cutting threads of the United States standard form of the following sizes: ⅜, 16; 7/16, 14; ½, 13; ⅝, 11; ¾, 10; ⅞, 9; 1 inch, 8. A countershaft, with Pratt's patent friction pulleys 10 × 3¼ inches, is furnished with the machine, and included in the price. The weight of the machine, with nut vise, seven taps and dies, and countershaft, is 850 pounds.

The Pratt & Whitney Company manufacture, in addition to screw-cutting machinery, all kinds of blacksmiths' drilling machines, planers, lathes, drills, milling, profiling, grinding and rifling machines, drop and tilt hammers, boring mills, presses, cranes, ratchet drills, cutters for teeth of gear wheels, combination lathe chucks, special machinery, etc., some of which we will illustrate and describe in future numbers.

A NEW MAGNETOMETER.—Mr. Geo. M. Hopkins describes and illustrates in the *Scientific American* a new magnetometer, invented by him to measure the variations in magnetization of the field magnets of a dynamo-electric machine. It consists of a concaved, horizontal, metallic plate and a chambered vulcanite cap, which hold firmly between them a steel diaphragm. Through the stuffing box of the vulcanite cap passes a glass tube of small caliber. The chamber of the vulcanite cap, which is closed by the diaphragm, is filled with mercury, so that any movement of the diaphragm, upward or downward, causes the mercury in the glass tube to rise and fall, thus indicating the attractive or repulsive force exerted upon the diaphragm. An instrument of similar construction serves as an electrometer.

Our Supply of Platinum.

If reports are to be trusted, it appears that the appeal of Mr. Edison to miners to give their attention to the search of platinum, will have effective results. At the late meeting of the American Association for the Advancement of Science, at Saratoga, N. Y., we saw a number of specimens exhibited by Mr. Edison, which he had received from various parts of the country, accompanied by statements, which would lead to the expectation that the supply can be made so abundant as to meet any demand without raising the price. The hope that platinum will become much cheaper than it is now, we fear will be vain. The cost of platinum, like other things, will depend a great deal upon the cost of production. It is a grave error to suppose that the high value placed upon gold and silver is only a fanciful agreement between men and nations, and that the noble metals are not subject to the same law as other products of industry. Those who think so ought only to visit the gold and silver mines of Colorado, or elsewhere, and see what immense labor it costs to obtain these metals. If in many instances the enterprise results in great profit, there are other instances where it entails loss, the value of the gold produced not covering the cost; in these cases of course the work is quickly abandoned. On the whole a coal mine is more profitable than a gold mine, and this fact alone should set the question at rest as to whether gold should not be regarded as a product of labor as well as any other metal.

We think, however, that for the benefit of scientific progress platinum should not cost much more than silver, its superior qualities being counterbalanced by its inferior appearance; gold and silver are beautiful metals, platinum scarcely looks as well as nickel, so that for ornamental purposes it will never be in demand, but only for the purposes of its utility in art and industry.

Among other localities, it is found in Santa Clara county, California, in a seam of talc; this talc is worked up and the platinum washed out and sold in San Francisco. However, the mining was done on individual account, and hence so imperfectly that it was abandoned for more profitable gold washings.

In Humboldt county, California, gold dust was sometimes so heavily alloyed with platinum that it was difficult to sell it, and the purchasers not knowing the value of platinum, would not pay more than $4 per ounce.

There is not the least doubt that platinum exists even in Nevada, where thus far it has not been found, but this for the simple reason that it has not been looked for.

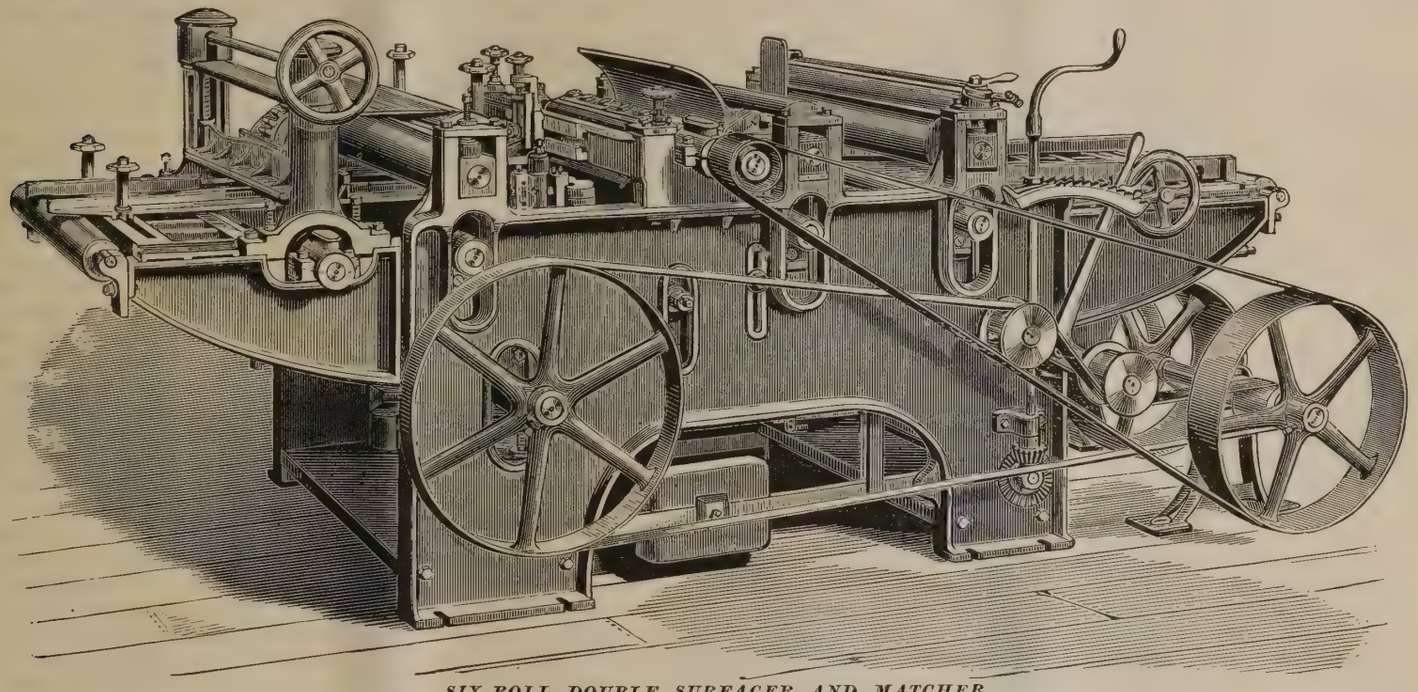
REDUCING THE WATER PRESSURE IN DELIVERY PIPES.—In order to relieve low-lying and branch mains, and domestic service pipes from excessive or unnecessary pressure, thereby reducing the liability to burst in the former case and of injury to house fittings in the latter, a very simple reducer has lately been applied in Glasgow, the action of which is as follows: A downward opening valve is inserted, which is perfectly balanced, so far as the inlet pressure is concerned; hence, if there be no pressure in the outlet main, it falls from its seat by its own weight and allows the water to pass; but when the pressure on the outlet main becomes sufficient to lift the valve, it forces it back to its seat, where it will remain until the pressure in the outlet is again relieved. All therefore that is necessary in order to obtain a fixed limit of pressure in the delivery pipe is to weight the valve, either by dead weight or spring and lever, to such an extent as to balance the intended pressure when acting on the valve. When this has been done, the pressure in the inlet may vary to any extent, but that in the outlet can never rise above the fixed limit.

SUBTERRANEAN FOSSIL FOREST.—In the neighborhood of Rotenburg, on the Fulda, Germany, the geologist, Dr. Moesta, has discovered a subterranean oak forest at a depth of 8 feet under the ground. The number of well preserved trunks is enormous. The wood is as black as Irish bog oak, in consequence of the influence of water for centuries, but it is hard and sound, and forms an excellent material for wood carving and mosaic. The size of the trunks is astonishing. One of them, about 57 feet in length and 5 feet in breadth, has been preserved for exhibtion in the Royal Museum at Berlin. The forest evidently belongs to a very remote period in the formation of our globe.

Six-Roll Double Surfacer and Matcher.

The continual improvement in large wood-working machines in this country, is something unparalleled in the history of industrial accomplishments. The machine represented in the adjoined engraving is of an entirely new design, and is one of the latest productions of the firm of Goodell & Waters, who have during the past summer made large additions and nearly doubled the capacity of their works at 3103 Chestnut street, Philadelphia. It is made in various forms, to work two, three or four sides, as a combined surfacer and matcher. It has a surfacing capacity of 24 inches by 6 inches thick, or may be had as a regular flooring machine to work 14 inches wide. The raising and lowering of the bed, by means of four heavy steel screws, connected and operated by a crank, adjusts it to different thicknesses.

The advantages attained in this adjustment by a raising or lowering of the bed, are: 1st. That the time required to make a change is incomparably shorter than it is by any other arrangement. 2d. The boxes of the upper cylinder can never get out of line, as they can in this case be made a part of the permanent frame. 3d. The manner of weighting the feed rolls is simplified, as a single rod of iron makes the connection of the weight lever with the feed-roll boxes. 4th. The machine consists of a lesser number of pieces, is simpler, and therefore less exposed to derangement, as there are no nuts or bolts to be loosened when a change is made. 5th. It reduces the hight of the machine, which therefore stands firmer. 6th. The parts are of easier access. 7th. There is nothing on top of the machine to become clogged up with dust or shavings.



SIX-ROLL DOUBLE SURFACER AND MATCHER.

The machine has six 5-inch feed rolls; the lower ones are driven by a train of 16-inch gearing, 2 inches wide on the face; the upper rolls are connected to the lower ones by a heavy expansion gearing, which makes a very powerful feed. The cylinder and matcher heads are made of steel and run in self-oiling boxes. The upper cylinder has three knives, and is 6 inches in diameter; the lower cylinder has two knives, and is 5 inches in diameter; both cylinders are fitted with beading cutters, which can be used or not as desired. The matcher heads are 5 inches in diameter, and the matcher spindles, running in heavy hangers, or castings supported by a 3-inch screw, are arranged to swing below the surface of the bed, by removing one bolt—a great convenience on a combined machine. The matcher head is adjusted, both at the end and side of the machine. Lumber can be worked the full width of the machine without removing the long guide; it is fitted with a good arrangement for holding the lumber to the guides, while it has all the pressure bars, chip breakers, and other accessories necessary to make it a complete machine in every respect. Every machine is thoroughly tested and made to work properly before it leaves the factory.

The weight of this form of machine is 5,500 pounds.

A New Nut Machine.—A new machine for sawing iron nuts has been invented in Springfield Mass. The nut on which this machine is designed to work is of ordinary iron, but with two slots cut at right angles across the upper surface half as deep as the nut, so that when it is turned tight upon the nut the grip of the wrench closes up the aperture so much that it is impossible for the nut to work loose. The new machine will cut the slots in the red-hot iron as fast as it can be fed. The nuts are placed upon an iron plate in front of the operator, who with one hand pushes them forward till they drop one by one into an open box fitted to them, in which they are moved by the gauge against a circular-saw. A motion of the hand then turns each a quarter of the way round, when it is pushed against a second saw for the other slit. Thus, after the first one is cut into in one direction, two are slotted in the opposite direction by the same forward pressure against the saws. The saws, of soft steel, revolve 3,000 times a minute, the periphery travelling nearly 4 miles per minute, (240 miles per hour), and the iron is sawed into as easily as a piece of wood on an ordinary machine. The machine will easily slot a ton of nuts, averaging 4,000 in number, in a day, and can probably be run up to a ton and a half.

American Deposits of Chemicals.

Rhodes' salt marsh, near Columbus, Nev., is a level valley of about 5,000 acres, containing several chemical compounds, each in a state of exceptional purity. In one spot there is an apparently inexhaustible supply of pure borax, which brings 3 cents per pound more than any other borax in the markets of the world. In this borax are natural large crystals, formed of the same substance, which are great curiosities, and known under the name of "tincal." There are also found in this deposit a fibrous crystalline borax and most curious specimens of borate of lime, which, from their apparent exterior form, are called "cotton balls." Sulphate of soda, or Glauber salts, is also found in large quantities and very pure; also sulphate of magnesia, or Epsom salts, in large deposits. It is the same with nitrate of potassa, or saltpeter, but thus far in lesser quantities; however, it is supposed that there is more of it than thus far has been brought to light.

There is also a quantity of common potash, said to be very abundant, and a new mineral which reports say is not described in any book, not crystalline, but irregular, and looking like branches of coral. As the miners do not know how to analyze it, they suppose it to be a new substance, and it is being sent East for inspection.

With all this variety there is one substance in the greatest abundance of all, namely, rock salt, as clear as ice, and which appears in most places when the sand on its surface is removed. Little streams of salt water bubble up through holes in the mass of salt, looking like air holes in a field of ice; they overflow the other salt, sometimes to a hight of 2 feet, and crystallize on it by evaporation. The salt is excellent for table use, and is also employed in the neighboring silver works to precipitate the silver solutions as chlorid of silver; for this purpose the solid rock salt is dug up with picks, and the quantity of course is fully sufficient to supply any demand in that region.

The valley is evidently an ancient lake bed, and is surrounded on all sides by volcanic mountains, which appear to act as chemical laboratories on a large scale, where bountiful nature manufactures this supply to provide for the wants of man, in this out of the way locality.

An American Obelisk.

A granite shaft in one piece, 59 feet long and 6 feet square, has just been quarried and shipped at Fox Island, near Rockland, on the coast of Maine, by the Bodwell Granite Company. It is intended for an obelisk memorial to the late General John E. Wool, to be erected near Troy, N. Y. It will be placed on a pedestal, of which the following are the dimensions:

Bottom base,	17½	feet	square,	2 feet high.
Second base,	14½	"	"	1¾ " "
Third base,	12½	"	"	1½ " "
Plinth,	11½	"	"	1 foot 7 inches high.
Die,	9	"	"	6 feet high.
Neck,	7¼	"	"	2 feet 7 inches.

The shaft has been shaped to be 5½ feet square at the bottom and 3 feet at the top. The weight of the monument is 100 tons, and when erected will be 90 feet high in all. The cost, exclusive of setting, is $60,000.

A Chance for Inventors.—A Buffalo (N. Y.) grape sugar company offers $10,000 "for any appliance to our boilers that will consume smoke and not diminish the quantity of steam now obtained."

Building Intelligence.

New York City Building Items.

The bachelor apartment house, in course of erection on the east side of Washington Square, and a description of which we published in our August number, has been christened the "Benedict," and will be ready for occupancy during the month of November.

Wm. H. Beers, architect, of 150 Broadway, this city, has just completed an extensive alteration to the mansion, No. 52 University Place, into an apartment house. This house was formerly occupied by the late Thomas Van Zandt, and is now owned and being altered for the heirs. The house is 32 feet wide by 55 feet in depth and four stories in hight. It is designed for one apartment on a floor, and the extra width makes each apartment light and well ventilated. The building is handsomely decorated throughout. The total cost of these improvements has been about $6,000.

On the south side of East Seventy-first street, between Fourth and Lexington avenues, Mr. Chas. MacDonald has just completed three houses, which are well worth the attention of those who admire progress in architecture and approve of a change in the monotonous style of buildings that line our up-town streets. Each house stands only upon a lot of 16.8x56, and yet there appears to be more room in the hallway than is generally found in a twenty foot house. True, it is done at the sacrifice of space in the front parlor, but the center and rear parlors make up for it in width, thus leaving the front parlor virtually to be used as a large reception room. The dining room is on the first floor in the rear of the parlor and extends across the full width of the house, while the middle room and parlor proper are lighted by a transom light, the dining room being lighted by a dome, giving the entire floor a most cheerful aspect. The rear room is connected with the kitchen by a stairway and dumbwaiter. In the wide hallway created by the cutting of the front room are large ornamental closets, adding considerably to the conveniences of a floor that is generally bereft of these features. The large front room in the basement is intended for a breakfast room, while the remainder of the basement is divided into a laundry, kitchen and storerooms, and withal there is a good sized yard. The houses are four stories high, of brown stone, and the front might be called a French Gothic. The plans were made by John G. Prague, architect.

Nothing indicates more forcibly the general revival of business prosperity than the number of new buildings which have been going up in this city during the last season, and the activity which prevails in the building trade at the present time. The following figures show the number and cost of new buildings for which plans were submitted during the first eight months of this year and the corresponding months of 1878:

	1878.		1879.	
	No. of Buildings.	Cost.	No. of Buildings.	Cost.
January....	77	$708,150	93	$758,558
February...	84	517,850	100	762,300
March.....	153	1,658,250	200	1,616,805
April.....	222	1,555,900	297	3,134,704
May.....	201	1,912,675	232	2,852,400
June.....	182	2,029,500	161	2,629,785
July.....	108	1,340,150	241	2,082,810
August.....	101	984,725	126	2,514,150
Total...	1,128	$10,707,200	1,450	$16,351,512

The foregoing statistics show that the increase in the number of new buildings this year was 322, and that the total increase in cost was $5,644,312. The alterations of buildings during the same months numbered 943 in 1878, at a cost of $2,018,147, and 1,071 in 1879, at a cost of $2,568,616. The increase in the number of alterations this year was therefore 128, and the increase in cost $550,469. The new buildings included structures of all classes, but a large proportion of them were dwellings. Many were in the up-town districts which had been opened to increased settlement by the construction of the elevated railroads, but there were also many in other parts of the city. As a general thing the buildings erected this year have been of a better order, in material and workmanship, than ever before. The revival of building has been due chiefly to the general improvement of business and the restoration of confidence in the future. Comparing the cost of material and labor at present with the corresponding period of last year the difference is very marked: North River brick, which cost last year about $5.50 per 1,000 delivered, cannot be obtained now, delivered, at less than from $7 to $7.50. On lime and cement there has been only a trifling advance. The wages of bricklayers last year were $2.50 per day, but since about the 1st of last June have been $3. Laborers' wages range from $1.75 to $2 per day, the former rate being the standard, while last year they varied from $1.50 to $1.75, with $1.50 as the standard. The wages of the plasterers are about $3 per day, while last year they were only about $2.50. The price of stone has advanced about 10 per centum since a year ago. Stone-cutters since the 1st of May have generally obtained $3 per day, while last year they received but from $2.50 to $2.75. Their wages, it is said, would have risen still higher but for the fact that the supply of labor has been increased by the arrival here of many good stone-cutters from Canada and Great Britain. Carpenters now receive from $2.25 to $2.50 per day, these rates being an increase of 25 cents over those prevailing last year. The prices of timber are about the same as in 1878, but the better qualities of lumber are a shade higher. Builders are now using great quantities of Georgia pine, which has become cheaper than white pine, while of much superior quality. The present cheapness of Georgia pine is due to the enterprise of northern men who have started mills, etc., in that State. Georgia pine timber, which cost $40 per 1,000 before the war, can now be bought for $26. There has been a general increase in the prices of builders' hardware. The advance in wages and on the price of iron—chiefly the latter—has caused an increase of about $10 per ton on manufactured iron of that description since a year ago.

Miscellaneous.

The new Catholic convent at Burlington, Vt., the foundations of which are now half built, will have a frontage of 170 feet and a depth of 61, and will be four stories in hight. The whole structure will be substantially built of brick and stone.

The erection of a new edifice for the Society of the First Unitarian Church at Buffalo, N. Y., has just begun on the west side of Delaware Avenue in that city. The width of the building will be 75 feet and the depth 150 feet. The material will be brick with stone finish, and the cost about $40,000.

Post & Company of Cincinnati, Ohio, whose building was destroyed by fire some months ago, have purchased a large tract outside of the business center of the city, and intend to erect thereon at once a new factory. The building will be 125 by a 190 feet, of brick, plain but substantial, and a first-class factory. The cost will be about $20,000. Charles Crapsey, architect, is now engaged upon the plans.

There is now building at Providence, R. I., for the Brown University two fine buildings—one for a Dormitory, of pressed brick and stone, which is situated on a line with the present buildings, and will cost about $40,000; the other for a Memorial Hall, which will be built of rock-faced granite in random courses, with Little Falls brown stone for trimmings, and will cost about $50,000. It is situated in the rear of the main buildings and on a line with the laboratory.

A new Catholic church is to be built at Newburgh, N. Y., by the congregation of St. Mary's Catholic Church, the plans for which have just been prepared by Mr. G. Powell, the architect. It is expected that the corner-stone will be laid sometime in November, and the church completed during next summer. It is to be built of the best brick, with blue-stone trimmings, and will be one of the finest church edifices in Newburgh. The design is of the Gothic order, and the plans call for a building 121 feet deep, with a frontage and width of 53 feet and 4 inches. The front is of handsome design. The side walls are to be 12 feet high, and from the same will run a slate roof 28 feet. The auditorium will be 73 feet in depth with a width of 50 feet, and will have seating accommodations for 800 people. What the cost of the church will be is not yet known, but is expected to be about $20,000.

The Brooklyn Theater, rebuilt on the site of the house destroyed by fire in December, 1876, is nearly completed. The owners taking warning by the costly experience gained, determined to make the building absolutely secure against fire, and they seem to have succeeded. The theater now fronts on Johnson street, but extends to Washington street. The entrances and exits are numerous and ample; the property-room and carpenter's shop are on the Washington street side, and entirely separated from the auditorium; the gallery has an exit to the hotel roof adjoining, and the gallery stairs are wholly separated from the body of the house by a thick brick wall extending to the roof. The stage, 107x40 feet, is cut off from the auditorium by a solid brick wall, 24 inches thick, carried up through the roof, and capped. Directly over the stage there are two immense iron tanks, with sprinklers attached, from which a flood of water can be discharged in a moment. In the construction of the ceiling, wire-cloth has been substituted for lath, at a largely increased expense, in order to secure the plaster from falling. Nothing seems to have been neglected. The Renaissance style of architecture has been chosen for the front. The lobby is spacious and airy, with iron staircases leading to the dress circle on either side. The frescoing is very rich, and the general effect of the house is attractive. The architect of the building, G. L. Morse, has had unlimited scope to make the house a model of strength and beauty, and has succeeded in his task, at a cost of about $100,000.

An arsenal is to be built at Newburgh, N. Y., by the State, the plans and specifications for which are now completed and in the hands of builders for the purpose of making tenders. The structure is to be two stories high, with basement, attic and a tower eighteen feet high in the center. The main entrance is to be through the tower, which will form a vestibule, after which there are to be steps descending about four feet to the drill hall, which will be located in that manner in order to economize in construction as well as to get an entrance level with the street at the side of the drill hall. From the main hall there are to be also two flights of stairs to a spectators' gallery, which will extend across the end of the drill hall. From this gallery landing there will be another wide flight of stairs to the hall in second story, by which the offices of the company will communicate, while another flight of stairs will lead to the tower, in which will be located the band room. The drill hall will be about 83x148 feet, with arched ceiling at an average hight of thirty feet. The roof will have a clear span and a clear story, the latter for light and ventilation. The drill hall will be further lighted with twenty-four circular windows, six feet diameter at the sides. The floor to the interior of the drill hall will be of ornamental brick work and plastering for the sides, while the timber work of the ceiling will be exposed. The administration portion of the building will be hard finished. The floors are to be of Georgia pine, the stair work and hall of ash, while the rest of the joiner work will be of pine, somewhat massive in detail. In the basement will be a full suit of apartments for the janitor, armorer's room, heating aparatus, etc. The exterior will be of brick with blue stone dressings up to the water-table, and above that granite dressings will be employed. The pilasters and rings around windows of drill hall, and all the friezes of cornices and the belt courses will be of Croton brick with black mortar joints, the balance of the brick work of common hards with gray mortar. The cornices will be wide and of iron. There are to be two bay windows on the first floor and two more at the front angles on the second story. All the windows throughout will have strong iron guards. The amount appropriated by the State for the erection of this building is $25,000. The architect is J. A. Wood, of this city.

A Novel Turbine Arrangement.

Turbine wheels as thus far employed, have most always been placed in a horizontal position, while in consequence the shaft was placed vertically. This may be advantageous under most circumstances, but it is often necessary to change the direction of the vertical rotating shaft into a horizontal one, and in this case some special arrangement of gearing or belts is used to effect this.

The firm of James Leffel & Co., of Springfield, Ohio, have recently commenced the manufacture of a turbine intended to be placed with its axis in a horizontal position, so as to make the special arrangement for changing the direction of the motion unnecessary. It is represented in the adjoined engraving, with its connections to the machinery to be operated. The water has access to one side of the wheel case, and its exit at the other, the shaft passing through proper packing boxes, while a workman is represented in the act of lubricating the anti-friction bearings. This shaft carries one or more driving pulleys, one of which is seen in our engraving. Its belt carries this power to the counter-shaft above, and from this to any other machine to be operated. It is evident that a first advantage of this arrangement is that it dispenses with the resistance unavoidably connected with gearing, or any other divice intended to change the direction of rotation. Another important advantage of this new arrangement is that every part is accessible for lubrication as well as for the purpose of examination at any time; while where gearing is used this is difficult, especially for small wheels under high heads.

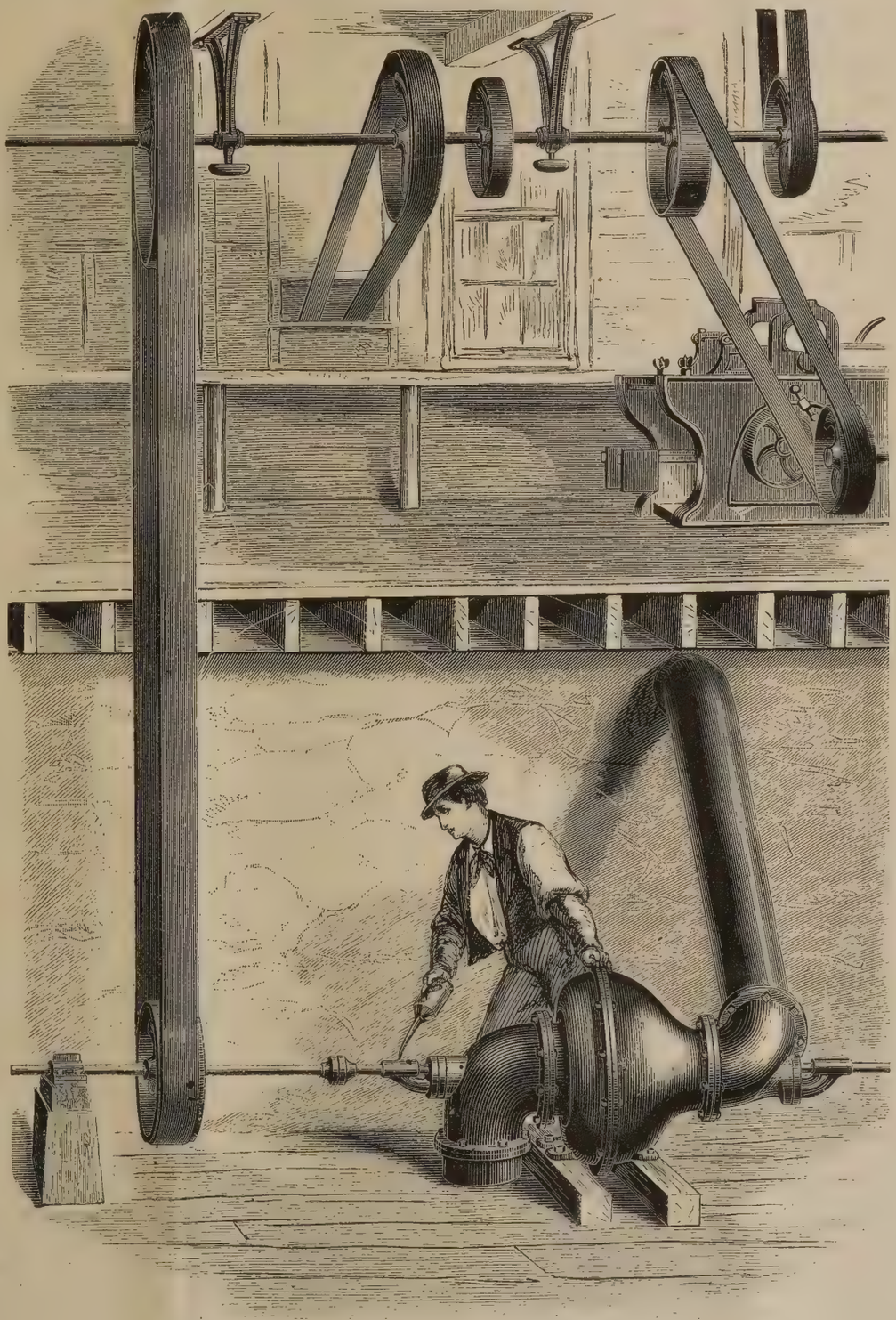
This arrangement, in connection with a peculiar patented device in the interior part of the casing, makes it possible to use a very small inlet and head pipe, so that on the whole this modification of the turbine is exceedingly well adapted for mining purposes, for pumping, for saw mills, and other machinery where it is important to have the moving parts as simple as possible. Our engraving fully shows this extreme simplicity, making other comments unnecessary.

We are informed that James Leffel & Co. will make these wheels up to 23 inches inclusive, and intend to apply the improvement to still larger sizes, where the peculiarity of the situation makes the application of this method the most practical. In the wheel itself the essential principles of the improved Leffel double turbine are retained, and as it has been applied to heads as high as 300 feet, the makers are confident that it will accomplish all that can reasonably be desired, and give satisfaction in all cases where it is possible to use a turbine.

We have carefully examined this wheel, and we are confident that it possesses the greatest power in the least possible space; that it has the smallest conducting pipe, and the simplest means of communicating the power to the machinery to be driven.

We have before us a letter of Mr. D. W. Jones, of Manchester, Iowa, in which he states some details in regard to the amount of machinery driven by such a wheel, and closing by expressing his conviction that there is no other such wheel running; while Mr. H. E. Fordham, of West Plattsburgh, N. Y., who uses four of them, after recommending the Leffel wheels in general, says that they are ahead of all other wheels he ever saw, and that they accomplish all that is claimed for them.

Messrs. James Leffel & Co. are so well known that it is scarcely necessary to state that they have their factory in Springfield, Ohio, and their office at 110 Liberty street, New York.



NOVEL STYLE OF TURBINE, WITH HORIZONTAL AXIS.

Improvement in Manufacturing Wood Gas.—The retorts are first brought to a red heat, after which carbonates and woody substances are introduced into them and the retorts closed. The woody substances at once ignite, the carbonates decomposing at a higher temperature, and the carbonic acid, in the presence of the vapor of water which arises either from the moisture of the substances themselves, or is introduced for the purpose, is disengaged from the carbonates passing through the glowing embers and produces oxid of carbon by the following re-action: $CO_2+C=2CO$; the mingled gases form one of a much greater bulk and of a much greater heating power than would be derived from the wood alone. One pound of wood gives 5 cubic feet of gas, and 1 pound of carbonates 9 cubic feet, or a total for the two of 14 cubic feet of a gas having a very great heating power. In 100 parts 79 are oxid of carbon, 9 hydrogen, and 8 proto-carbonated hydrogen, (these three gases giving the maximum temperature which can be obtained with large flames); besides these, there are 3.5 parts of carbonic acid and 0.5 parts nitrogen, but the proportion of these inert gases is so small that they do not detract from the qualities of the gas. The gas, on leaving the retorts, is cooled by the ordinary methods, and is thus caused to deposit its tar and the pyroligneous liquids, and is then taken direct to the gas holders for use. Directly gas ceases to be given off, the charge is withdrawn and a second one introduced. The use of water to assist decomposition depends on the condition of the materials employed.

This gas can be used whether purified or not, in closed or open chambers, with or without the aid of air or steam, under any pressure, and for every manufacturing and domestic purpose, whether for heating or lighting. It is claimed that it can effect these objects at a saving of from 33 to 80 per cent for heating, and from 10 to 25 per cent for lighting, over any other

means at present known. It is said to effect this saving partly from avoiding the loss of heat ensuing from the combustion of solids, and partly from the value of the products remaining after the manufacture of the gas, such as charcoal, tar, lime, etc. It is stated that 1 ton of wood and 1 ton of carbonates produce 28,254 cubic feet of gas, weighing at the rate of 1 pound to the cubic foot, while 1 pound of this gas is claimed to be equivalent in heating power to 4 pounds of average coal.

Our Bluestone Sidewalks.

Bluestone was first quarried for flagging, and all stone found thicker than necessary for that purpose, and which is now the most valuable, was either broken or thrown away as worthless. Consequently many quarries that were worked out of flagging and abandoned have since been re-opened and proven most valuable. Bluestone is now used for flagging, curbing, paving, cross walks, copings, water-tables, door and window sills, and everything, in fact, that stone is used for in connection with buildings. Bluestone is being used for trimmings in some of the finest buildings erected im New York. The works of Mr. Maxwell, at Malden, are at present engaged in turning out some of the finest manufactured stone ever produced. It is for the elegant new residence of William H. Vanderbilt, on Fifth avenue, New York. Bluestone is coming into very general use for sidewalks, and for this purpose has no superior, as it has great strength and durability and possesses a degree of roughness which is not lost by wear or action of the weather. It will dry very quickly, as its color draws the sun, and when smooth or wet is not at all slippery and absorbs no moisture whatever.

The sidewalks of Fifth avenue and other noted thoroughfares in New York, Boston, and Philadelphia, require stone 15 feet long, and from 8 to 12 feet wide, planed, axed and finished in the best manner; bluestone being used very largely for this purpose. It was only with great difficulty that bluestone was originally introduced into the markets of New York, Boston, and other large cities, but once used it recommended itself. In 1873 it is estimated there were 3,000 men and boys engaged in quarrying in the town of Saugerties.

Of the numerous small hamlets that sprung into existence through the more thickly settled quarry districts in the town of Saugerties, Quarryville (appropriately named) is the oldest and largest. In 1873 it is estimated to have had a population of 1,200, but at the present time there are probably not more than half that number of inhabitants, the falling off in the demand for stone having caused many to seek employment elsewhere. Most of these people are of Irish and German nationality.

Elisha Parks, a pioneer quarryman, was the first to settle here and build himself a home. He was soon followed in this respect by Wm. Van Valkenburgh, Thos. Maxwell and others. Extensive quarries were opened on the lands of Messrs. Plough, Wynkoop and Crawford. From 1840 to 1850 between 60 and 100 loads of stone came to Malden daily from Quarryville.

"Bluestone" is simply a local term given a stone, of which the proper name is "Graywacke." This is a partially translated German word used as the name of a rock formed of heated clay, common in, though not confined to the Silurian and Cambrian strata. It is an extraordinary fact that in the vicinity of St Petersburg the Silurian system contains beds of unconsolidated clay. A visit to any of our brick yards will show that the layers of blue clay are the same as that of the bluestone in our quarries, hence it is reasonable to suppose that at some stage of the world's history bluestone was blue clay and that by the action of heat it was brought to its present state; its color and composition would still further show this.

The Silurian system occurs in the basin of Hudson's Bay, in the valley of the river St. Lawrence, and in valley of Lake Champlain. In portions of New York State it is most fully developed, with a great number of sub-divisions in regular layers, one upon the other, with out-crops in favorable condition for examination. These rocks occur also in England, Belgium, Germany, Norway, Sweden, and Russia. A great variety of rock is comprised in this system. Hard sandstones, fine slates, and flagging stones constitute a large part. Conglomerates are less common. Many formations consist largely of limestone. Prof. James Hall, in a description of three of the classes of this system—the Helderberg, the Hudson River, and the Portage—in which graywacke is quarried to any extent, says: "Hundreds of fossils have been found in these groups, a large majority however of them are shells. Snakes, toads, worms, coral and star fish have been found in bluestone. From the great number of species of shells in the Silurian system within the state of New York it may be inferred that the climate was tropical, or, at least much warmer than it is now; for at the present time, it is only in warm regions that so great a profusion of species is found in such limited areas."

Graywacke belongs to the fourth class in stratified rocks, the character of the rock being clearly defined by an examination of the deposition. It forms a stratum which is generally about two feet thick, and can be split out in slabs of almost any desired size. The rock is transversed by joints that divide the slabs about perpendicular to their layers, and are as smooth as if cut by a saw, which greatly facilitates the labor of the quarrymen. Gray & Adams, in their "Elements of Geology," in speaking of the formation of rocks, state that "thin layers of fine material and of very uniform thickness are deposited from quiet waters, and those which consist of coarse gravel and pebbles are the products of agitated waters. The layers of the stratified rock, originally mud, sand, gravel, shells, coral, etc., have become solid by the agency of heat, pressure, cohesion, crystallization, etc. Unstratified rocks have been erupted in a melted condition at different periods in the history of the earth."

Prof. William W. Mather, in his report of the first geological district of New York, says: "The quantity of bluestone is so great that it cannot be exhausted; it has been traced, exclusive of its sinuosities produced by valleys intersecting its plane, a distance of 140 miles in the first geological district, and it undoubtedly underlies all the country that is occupied by that portion of the Catskill and Erie division that overlies this rock." The results of glacial action are apparent in many bluestone quarries in the vicinity of Saugerties.

In regard to the history of its quarrying in this country, we may state that the first bluestone quarry was at Mossy Hill, in the town of Coeymans, Albany county, N. Y., about 1829–30. In 1831 Silas Brainard, a bridge builder from Connecticut, while engaged in his calling in the town of Saugerties, learned of the bluestone quarry at Coeymans, and visited it. On returning to Saugerties, he found the same class of stone on the farm of William Van Valkenburg, situated three miles west of the village, and purchased 20 acres and opened thereon a quarry. The following year his nephew, Nelson Brainard, at present a well-known marble dealer in Saugerties, purchased the remainder of the farm—some 80 acres—and opened thereon quarries of very superior stone. Many quarrymen came from Albany county, and the business rapidly extended until at present bluestone quarries are worked from the Helderburgh mountains south of Schenectady down along the Hudson and Catskills, thence along the line of the Delaware & Hudson Canal to the Alleghanies in Pike county, Pa., and millions of dollars have been invested in this great industry. The supply is practically inexhaustible, while the business is really in its infancy. The principal quarries are in the counties of Ulster, Greene, Albany and Sullivan. Of these Ulster undoubtedly has the most extensive. Mr. J. O. Beers, of Saugerties, for many years interested in the bluestone business, followed the out-cropping bluestone strata in 1862 for three months on foot from the Helderburgh mountains to Pike county, Pa., where the strata ends as abruptly as the walls of a precipice.

In 1864 the Bigelow Stone Company was formed, with a capital of $300,000, managed by E. & D. Bigelow and Nathan Kellogg. On the retirement of the Bigelows and Kellogg the affairs and management of the company passed under the control of H. T. Caswell, Troy, and John Maxwell and F. K. Field, of Malden. They made extensive improvements in the buildings, manufacturing departments and docks, and for several years their annual sales amounted to one and a quarter million dollars.

In the spring of 1875 John Maxwell purchased all the vessels, tools and stone the company had on hand, and leased their entire establishment for a long term of years. To-day Mr. Maxwell is undoubtedly the largest stone dealer in the United States. From 400 to 500 men are employed in quarrying the stone he buys, while in his mill and yard at Malden he employs about 125 more. He purchases stone at Malden, Saugerties and Glasco, also on the line of the Ulster & Delaware Railroad, on the Delaware & Hudson Canal, on the Erie Railroad and several of its connections, the stone reaching tide-water from the latter source at Newburgh, Jersey City and Newark.

In 1875 the sales of Mr. Maxwell amounted to nearly $900,000. The demand for stone is increasing, and it is estimated that the sales of stone on the Hudson river will amount to more than $1,000,000 this year.

Gasolin and Kerosene.

The recent total destruction by fire of the Locust Grove Hotel, on Long Island, involving the loss of several lives, has induced our dailies to repeat the old tirades against the use of dangerous kerosene, send reporters to Professor Chandler and other experts in the matter, and fill their columns with a re-hash of the often explained difference between good kerosene and gasolin.

Scarcely any of them seem to be aware of the changed circumstances. Ten years ago benzin and gasolin were drugs in the market, while at the present day there is such a demand for them that it is no object to adulterate kerosene with them—in fact, kerosene is as cheap as the other more volatile oils, if not the cheapest of them all, next to the crude oil. Kerosene had nothing to do with the Locust Grove Hotel fire; it was caused by the ignorance of an employee who entered a room with a light to pour gasolin from one can into another. This substance is much more dangerous than gunpowder, because it continually evolves combustible vapors, especially in warm weather, and when these vapors come in contact with a flame they ignite and communicate the fire at once to the liquid. It was negligence on the part of the managers of the hotel not to have informed the person who had charge of the room in which the oil was kept of the dangerous character of that substance; and was even negligence to have kept such a substance stored in the hotel, especially as it was a frame structure, a class of buildings always liable to take fire, and when once started, are doomed to be burned to the ground.

We hope that this catastrophe will be a lesson to others, but fear that it will not be the last lesson, as it takes a very long time to get the conviction of the necessity of prudence into the heads of average people.

Ulster County Mill Stones.

The industry of quarrying mill stones along the Shawangunk mountains, in the vicinity of Alligerville, N. Y., and through that section for a number of miles, has become quite a large business. These stones in some cases are very large, often measuring in diameter from 5 to 6 feet, and weighing as much as 4 tons. After being lifted from the quarry, they are rounded by workmen, and a hole drilled through the center for the axle. They are extremely hard and flinty, so that the hardest kinds of instruments have to be used in working on them, which work is done entirely by hand with the hammer and point. The ordinary tools used in the bluestone business would be pointless after one or two clips on this hard, gritty rock. They are principally shipped from Alligerville.

These stones are mostly used for grinding in grist

mills, and for grinding cement. Three of these stones recently quarried about two miles from the bank of the canal, are enormous, measuring, after being rounded, 6 feet in diameter and 20 inches thick; they weigh 4 tons, and it required a great deal of labor to get them from the quarry to the dock, owing to the softness of the road bed, the wheels of the wagons cutting in to the hubs every little distance. The roads will have to be considerably improved if this business continues to increase.

Pumping by Steam.

BY J. C. BAYLES.

In a great many locations where power has to be employed in raising water, steam is the only power which can be conveniently applied. It is suitable for almost any situation, is easily managed, is generally understood by mechanics, and presents no difficulties not easily overcome. Its universal adaptability and the immense demand for steam-driven pumps has turned the attention of engineers and capitalists in this direction, and at the present time the manufacture of steam pumps and their accessories is one of the largest industries in the country. It is interesting to note the fact that James Watt, the so-called father of the steam engine, was really a steam-pump man, all his engines for a great many years being devoted entirely to the pumping of water out of mines. The application of the steam engine to the furnishing of power for other purposes was done by other persons while Watt was busy with pumps. The manufacturer of to-day has so simplified and cheapened the steam pump that, while its cost is very small, its management is so simple that it may almost be said to be perfectly automatic. The chief item of cost, and the portion of the apparatus requiring the most attention and care, is the boiler. In cases where steam for heating is employed, a steam pump can be used without any additional trouble. Many people fear to use steam boilers on account of the supposed danger attending them, and an idea that the insurance will be increased by them. There are a great number of boilers in the market which can be used in insured buildings, the companies considering them no more dangerous than a coal stove.

I have in mind one among the many excellent steam pumps for light duty which may be taken as an illustration of the best machines of its kind in use. The pump is 2 inches in diameter and 6 inches strokes. The steam cylinder has the same length of stroke, and is 5½ inches in diameter. The pump discharges .08 of gallon of water at each stroke, and when running at an ordinary rate of speed makes 100 strokes and delivers 8 gallons of water per minute. It can with ease be run up to a speed of 150 strokes, when it would deliver 12 gallons per minute. The pump will run even faster than this, but it would not be advisable to keep it running steadily at a higher speed because the wear and tear would become too great. The boiler, which consists of a coil of steam pipe inclosed in a suitable case, is perfectly safe against explosion. The ordinary pressure carried is from 5 to 30 pounds per square inch, while the boiler is tested to 300 pounds per square inch. With 7 pounds pressure in the boiler the pump will force water 50 feet high. In such a case the boiler is fed from the tank, the pressure being sufficiently great to force the water into it against the pressure of the steam. The boiler and pump form an arrangement complete in itself, and may be used for warming as well as pumping, the boilers in such cases being made larger to suit the service required of them. An indictator or steam gauge is attached which shows the pressure, and there is a safety-valve by which the pressure is prevented from rising above the desired point. The pump is so arranged that it is always ready to start as soon as there is steam pressure in the boiler, provided, of course, the steam valve is left open. The amount of coal required to run one of these pumps is very small. It is stated, on good authority, that 30 pounds of coal will run one 8 hours, discharging 13 gallons of water per minute 95 feet high, or a little more than 6,200 gallons of water raised 65 feet high at a cost of, say, 10 cents.* The cost of pumping the same amount by hand would be, at least $1.50, and perhaps more. One of these pumps and boilers is calculated to furnish all the water required by 12 families, yet they are capable of doing much more. In a French apartment house in New York one of these pumps and boilers is supplying 24 families with water. It is in this case, however, somewhat overtasked, and the supply at times is a little scant.

With a pressure of 12 pounds per square inch, pumping 70 feet high, one of these pumps has run continuously at 150 strokes per minute, delivering upwards of 700 gallons per hour. When less water is needed the pump can be run slower and the consumption of coal will be proportionately less. The principal parts of the pump are brass, for the purpose of preventing corrosion. The steam pipe is half inch in diameter, and the exhaust three quarters. The discharge pipe is 1 inch; suction, 1½ inch. The boiler is but 3 feet high, and takes up a space 2 feet in diameter. In case of the grossest neglect possible, the only damage which could be done to the boiler by cutting off the supply would be to rupture one of the pipes of which it is made, and so allow steam and water to escape and put out the fire.

Another pump for a similar purpose, but constructed on an entirely different plan, has recently been attracting a good deal of attention. Gas or kerosene is the fuel used. It is not of the direct-acting kind, like that just described, but has an oscillating cylinder which drives after the ordinary manner a shaft to which the pump is attached. This machine is made perfectly automatic in all respects save, perhaps, that of oiling all its bearings. It keeps the steam pressure constant by turning on or off the gas or kerosene as the pressure tends to vary. The water supply is also self-regulating, the feed pump sending water into the tank when it is not needed in the boiler. When gas is used, five or six minutes are sufficient to get up steam. One of these engines will pump 10 barrels of water per hour at a cost of about 6 cents. It only occupies about as much space as a flour barrel, and weighs 250 pounds. This engine possesses another point, sometimes of great value, and that is it can furnish power for light work, such as running a turning lathe or sewing machine. The principal objection to these pumps is that they are not very strong, and are likely to wear out somewhat sooner than is desirable.

* [*Note.*—A slight calculation shows that the pump referred to is far from reaching the economy required in the present condition of steam engineering; 30 pounds of coal in 8 hours is very nearly 4 pounds per hour, which ought to produce at least 1 horse-power. Large engines of the improved pattern have even produced a horse-power for half that amount of coal. Thirteen gallons of water raised 95 feet per minute is very nearly 10,000 foot-pounds—less than one-third of a horse-power. According to the other statement, 6,200 gallons raised 65 feet high, which is nearly 4,000,000 foot-pounds, costs 10 cents for fuel, or 2 cents for 800,000 foot-pounds. Two cents' worth of coal is about 10 pounds, so that 4 pounds of coal will give 320,000 foot-pounds per hour, or 5,333 foot-pounds per minute—only about one-sixth of a horse-power.

We mention these facts only as a proof that still much greater economy may be obtained when the proper conditions are attended to.—*Editor.*]

Cotton Culture in Russia.—Cotton growing is assuming large dimensions in the Central Asiatic provinces of Russia, reaching yearly at present more than 100,000,000 pounds, which is partly utilized in local industries and partly finds its way to Russia, which again returns a considerable proportion in the shape of cotton fabrics. As the northern boundary of the cotton zone in Turkestan, the valley of the river Arys is usually taken; but also in the region around Tashkend a considerable quantity of cotton is grown, which ripens about October. In these regions the American long fiber cotton also flourishes; yet in spite of repeated attempts to introduce its culture, it has made but little headway. Better than the cotton of Tashkend and Kojend is the Bokharian cotton, which by careful attention to the plantations, is said to approach the American long fiber kinds in quality. The largest crops of cotton are obtained in Khiva, and the smallest in the northern cities of the Turkestan region.

Success with Mineral Oils.

At a late meeting of the Railway Master Mechanics' Association of the United States, there was rendered a report of a committee appointed to examine into and report on the subject of lubricants. They recommended a good quality of natural earth oils as the best to use for lubricating machinery and journal boxes. It was less expensive, and of a better quality than other oils. When treated so as to reach 28° of gravity, it was found to work with perfect success, even on so sandy a road as the Lake Shore. It had been reported favorably on from Canada in the North to Kentucky in the South. A test of various oils had been made with the oil tester on the Lake Shore road; sperm, lard and tallow were used, and none of them were found to possess qualities which render their use advisable. In their experiments the committee used a machine the size of a regular axle box, and 50 drops were poured in at a temperature of 60°, and the wheel was allowed to revolve at a rate of speed equalling 35 miles per hour until a temperature of 200° was reached. The length of time, number of revolutions, and amount of friction were all noted and placed in the form of a table. Attention was called to the result obtained from tests with paraffin, which costs from 25 to 30 cents per gallon, and which has been used on railroads in preference to lard oil. Paraffin costing 25 cents, with which six experiments had been made, showed that 24 minutes were required to reach the maximum temperature, during which time it gave 11,685 revolutions; castor oil, costing $1.25, which required 28 minutes to reach the temperature allowed, gave 12,946 revolutions; manufactured oils—A, B and C—costing 35 cents, 90 cents and 25 cents respectively, required 19¼ minutes, giving from 9,285 to 9,653 revolutions; sperm and tallow required only 17 minutes to reach 200° temperature, with less than 8,000 revolutions.

The New Steam Catamaran.

The Poughkeepsie *Eagle* reports that the machinery for the steam catamaran (referred to on page 202 of our September number, and the details regarding which were taken from the New York *Tribune*), built at Fishkill on the Hudson, is completed, and mentions the following additional peculiarities:

"As the boat has two distinct parts, each part has machinery of its own, which may be operated independently, and are duplicates of each other in all respects. The boilers are of the locomotive type, having internal furnaces and a large number of small horizontal tubes—the smoke pipes to be on the back ends of the boilers. Each of these boilers is about 25 horse-power, and they are placed in the holds of the boat as low as possible. They are well supplied with valves, gauges, etc., for steam and water, and each has a small steam donkey pump to force the feed water into the boiler, and also a heater in which water is warmed before it passes to the boiler. The engines are non-condensing inclined cylinder, and are each about 25 horse-power; they are provided with the usual link motion for operating the valves and for running the engines when necessary. They are plain and simple, with few parts, and connect at the crank pins with two cranks upon the paddle-wheel shafts. There are four of these shafts, two to each part of the boat, one right and left from each engine, and a paddle-wheel is fastened to each, so that there are four paddle-wheels. The engines are to be worked from the deck of the boat, and levers, etc., are arranged so that all will be convenient for the engineer in charge."

Reckoning Dates While Travelling Around the World.

The question as to how a day may be gained or lost by travelling around the world eastward or westward, and to which we devoted an article on page 179 of our August number, was very lucidly treated by Prof. Davidson in a popular explanation given at the Academy of Sciences in London. He started a traveller westward from London, or rather from the meridian of Greenwich, precisely at noon, and he made him travel around the globe at precisely the rate of speed that the earth carries us eastward in its daily whirl of 24 hours. The traveller is always in local time at meridian; he goes around the globe in 24 hours, and it is always noon with him. At New York his application of time agrees with the clocks of the city, but his watch, which was at 12, noon, when he left London, is now 5 P.M. He goes still westward, and in longitude 120, the border meridian of Nevada and California, he is still at noon locally, and his watch indicates Greenwich time to be 8 P.M. In longitude 180, the sun is at meridian, and his watch shows that the time occupied by his journey is 12 hours; and in the longitude of the Ganges 18 hours have elapsed; and, continuing his transit to Greenwich, he has still the sun in meridian, and finds that 24 hours have been lost. The rising and setting of the sun for one day has been witnessed by the people of London and not by the traveller. Actual time is the same, but in his case the division has not been marked. Going west, at 180 degrees of longitude, the navigator adds a day if it is Friday, Saturday is skipped and Sunday is proclaimed, to the consternation of the ship's parson, who is affrighted lest the prayers of the service may not have the same efficacy. Coming eastward a day is gained, and if it is Saturday when the meridian is reached, Sunday is made into another Saturday, and Monday becomes Sunday. Care is always taken to avoid the conjunction of two Sundays, as that would demoralize any crew.

Action of Fatty Matter in Boilers.

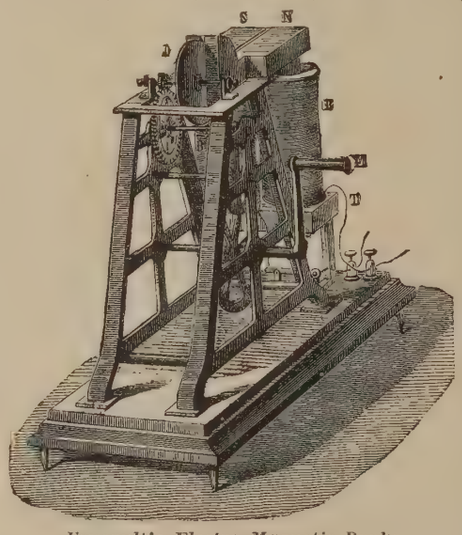
M. G. Pereyra gives, in the *Annales des Mines*, the results of researches made to ascertain the origin and action of fatty lime deposits in boilers fed with the condensation water of surface condensers. A deposit collected in such a boiler yielded the following results by analysis:

Carbonate of lime	83.75
Carbonate of magnesia	2.71
Sulphate of lime	2.04
Lime in excess	3.14
Organic matter	2.24
Fatty matter	1.01
Oxid of iron	2.22
Silica	1.90
Water	0.80
Not ascertained and loss	0.19
Total	100.00

This deposit was pulverulent and of a grayish color, adhering but slightly to the heating surface of the boiler. It was not wetted by cold water, but during ebullition was promptly wetted and mixed with the liquid. When boiled with water, in which it was mixed in the proportion of at least one-half per cent, the liquid, increased in volume, became an emulsion, like boiling milk. The emulsion was increased with the proportion of the deposit; but when the same substance was calcined, it could be wetted with cold water, and it ceased to cause emulsion when boiled. Fatty deposits generated without pressure, as in the hot well of a condensing engine or artificially in the open air, did not, when boiled with water, cause emulsion; and Mr. Pereyra infers that pressure is necessary to the production of an emulsion-making composition of lime and water. He concludes that the overheating of boiler plates covered by the emulsion composed of fatty matter and water is due simply to the non-conducting power of this compound. If the deposit is rich in fatty matter, it is corrosive and adherent; if poor in fatty matter, and formed under low pressure, it acts simply like boiler scale.

Finding the Mechanical Equivalent of Heat by Electro-Magnetism.

The strongest proof of the correctness of a numerical result is, undoubtedly, that the same figures are constantly arrived at when totally different means and principles are employed in the solution of a problem. Thus, in the case of the celebrated problem of the quadrature of the circle, the relation for the length of diameter and circumference of 1 to 3.14159265, etc., is obtained whether we use the elaborate method of approximations by calculating the periphery of polygons of many sides inscribed and circumscribed to the circle, or by calculating their surfaces; or if we apply trigonometry and calculate the arcs of given sines; or, again, if we apply the infinite series found by Leibnitz and others, or the continuous fractions expressing this relation; or, finally, the differential calculus—absolutely the same result is arrived at in each case, which is the best refutation to those circle squarers who either do not understand mathematics, or whose mathematical ideas are confused, and who, besides this, all differ among



Foucault's Electro-Magnetic Brake.

themselves, each obtaining a totally different number—the result of false reasoning.

The number of 772 foot-pounds for the equivalent of one unit of heat—first approximately obtained by Benjamin Thompson, and later more correctly by Joule and others—is in the same condition of absolute certainty. It means that 772 foot-pounds of force applied, and apparently destroyed by resistance, will reappear as one unit of heat—that is, will heat one pound of water one degree Fah. Thompson tried to obtain this relation by using horse-power in the boring of cannon and measuring the quantity and temperature of the water he could heat by the friction produced. Joule in England used paddle-wheels immersed in water, oil, mercury, and other liquids, and put in rotary motion by means of a weight; the descent of the weight produced a corresponding ascent of temperature in the liquid agitated, and the heat measured and compared with the weight and its descent.

Mayer in Germany compressed air, and observing the heat generated by this compression, compared it with the power applied. The results of these observations, when carefully corrected for disturbing influences, (for which we have not space here to give in detail), produced results identical with the above mentioned figures.

Passing over other methods employed with the same purpose in view, such as friction between solids, which is one of the most common impediments to motion, and which always produces an amount of heat equivalent to the motion destroyed, we will only describe one of the most remarkable of this class, consisting in the application of resistance to motion produced by magnetic attraction, without any friction by contact, but by a purely magnetic action through an intervening space.

Arago first observed that when a copper disk is rapidly rotated under a compass needle, it acts on it at a distance and causes it to rotate also; while Faraday discovered that when a small piece of copper is suspended by a fine thread and made to whirl around, it will be arrested if a strong magnet is held near it, and when it is made to revolve by force the resistance of the magnetic action will cause it to become warm.

Foucault modified this experiment in such a way as to be able to compare the heat thus developed with the power applied. His apparatus is illustrated in the adjoined engraving, which is a representation of the form in possession of the Stevens Institute of Technology in Hoboken, N. J. It consists of a powerful electro-magnet B, of which the poles are turned upward, and provided with a soft iron armature that expands at both sides of a copper disk D, ¼ of an inch thick and 3 inches in diameter, and embraces nearly one-half of it, being as close to it as is practical without contact. To the disk a very rapid rotation may be given by means of the handle M and intervening gearing. When the electro-magnets are not charged, it is quite easy to make the disk turn with a velocity of from 150 to 200 revolutions per second; and when left to itself the motion will continue for some little time by the momentum of the moving parts; but if the current of a voltaic battery is caused to pass through the coils surrounding the electro-magnet, the motion will not only be instantly stopped, but a strong resistance will be felt when the handle is turned. When three Bunsen elements are used and the motion forcibly continued, the apparent destruction of the efforts will reappear as heat, and the temperature of the disk can be easily raised some 100°, while, by increasing the battery current sufficiently, the resistance may be made too great for a man to overcome.

A comparison between the heat thus obtained with the power applied, will, when reduced to units and descending weights, give the same result of 772 foot-pounds as equivalent to a unit of heat. Joule used a tube with water, having a thermometer inside, and rotated it forcibly between the armatures of the poles of a magnet, properly shaped to receive the tube. He found the same figures in a more direct manner than was possible with the disk.

The explanation of all this is that the magnetism develops induced circulating electric currents in any conducting mass moving under its attractive influence, and these currents develop heat, as is the case with all electric currents, while the amount of this heat depends on the strength of the currents and the resistance they undergo.

How to Find the Strength of Timber.

We are indebted to Mr. C. K. Weed, Jr., of New Canaan, Conn., for calling our attention to an omission in rule 6th, under the above heading, on page 183 of our August number, for finding the dimensions of a beam of given length required to carry a given load. It should read: "The product of the breadth with the square of the depth equals the load at the center, *multiplied by the length of the beam*, and divided by 90 for pine, or by the number found under Rule 4, for any any other material." The part that was omitted is now italicized.

Gas-Light Experiments.—Some experiments recently made by the London gas companies, have verified, what was known before, that when the luminosity of gas burners is improved by greater consumption, the light produced is increased in a greater ratio than the cost; so that improved and larger burners, consuming three times as much gas as a greater number of small ones, and therefore costing three times as much to feed, the light obtained was 4½ times as great.

The Nicaraguan Ship Canal.

As matters appear at present, it looks as if we were going to have two canals across the American Isthmus, one at the level of the ocean, near Panama, with a gigantic tunnel, but without locks; and another canal above the ocean level, passing through Lake Nicaragua, and having many locks, but no tunnel. The latter was described by us in a former number, and has for a long time been the favorite plan of the United States, and this for two reasons: First, it is nearest to us, and would save more than a thousand miles travel between our Atlantic and Pacific seaports over the more southern Panama route. Second, it will cost considerably less than the Panama canal with its gigantic cuttings and tunnelling through a mountain range.

The European governments are perfectly convinced of the benefit that will accrue to the United States from the Nicaragua canal; they know the fesibility and even comparative ease with which the plan can be executed, and also of the financial capability of the United States to do it, especially when the merchant princes of the East combine with those of California. They object, however, to having the canal an American enterprise, and under the special protection of the United States. What they want is a canal that, notwithstanding on American soil, shall be neutral, and even, if possible, rather under the special protection of the great European powers; and this is the secret power which has moved the late Paris Congress, in regard to which it now appears that it had *a priori* been decided not to favor America's pet scheme, but to select the most southern route, which is just as good as any other for Europe, but not so good for the United States.

Our government, suspecting results unfavorable to American interests, wisely did not send delegates with power, as in that case we might be held by the decision of the Paris Congress. Representatives only were sent, and these merely charged to set forth what had been accomplished by our surveys and the conclusions of the American commission appointed during Grant's administration. As was expected, American interests were discarded, and, as is well known, M. de Lessep's pet scheme of a canal without locks adopted, chiefly for political reasons—to enlarge the interests of the European powers on the isthmus. Now, this is totally contrary to the doctrine promulgated by John Quincy Adams and Munroe, not to tolerate an increase of European influence on this continent, and hence the matter is agitated among us to construct the Nicaraguan canal as an exclusively American enterprise, by American engineers.

The Paris Congress was only an attempt to head us off in the Nicaraguan enterprise by interesting European capital in a competing scheme. Our present prosperity will enable us to construct that canal in spite of all European attempts at competition. Our American engineers are pressing the matter; they have offered the Presidency of the Nicaraguan Company to ex-President Grant, and he has accepted. He carried the war for the union of the United States to a successful issue, and we hope he will with equal success carry this peaceful enterprise to victory. It will be far more honor to him than a third Presidential term, which he wisely refuses. Let him crown the end of his life with victories of peace, far more blessed in their results than the victories of war or politics.

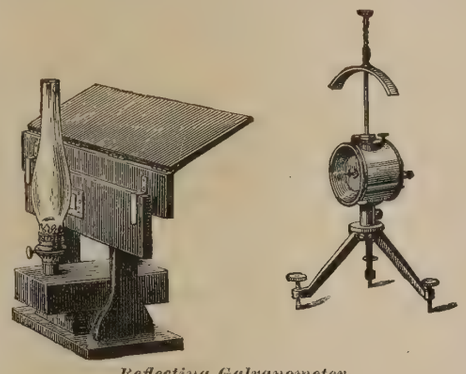
The Fastest of all Steamers.

It appears that the marine engineers of Great Britain have succeeded in constructing the swiftest ship in existence, by taking a hull of 300 feet in length, 46 feet beam, and 16 feet hold, and filling the hull almost entirely with the machinery driving it, consisting of 12 boilers, with 65 pounds pressure, and two independent engines of 4,000 horse-power each, and each driving one of the twin screws. Both of these engines have two high-pressure and two low-pressure cylinders, the first are 41 inches and the latter 75 inches in diameter, with a stroke of 3 feet. On a trial trip a speed of 22 miles per hour was attained, but then the consumption of coal was as much as 10 tons per hour; this, however, is tolerably economical when compared with the power developed, being 2½ pounds per horse-power per hour. As the vessel has a displacement of 3,750 tons, most of which is taken up with the machinery, it will only be armed with ten 64-pounders.

Reflecting Galvanometers.

The name "galvanometer" has, by general consent, become confined to instruments based on the discovery of Oersted, that the compass needle tends to place itself across—that is, at right angles to a galvanic current. If the conducting wire is placed in the direction of the magnetic meridian, so that the compass needle just over it is parallel to the same, it will deviate to the right or left, and the amount of this deviation will be proportional to the strength of the current, so that this deviation gives a measure for its strength.

Very strong currents will deviate a needle even when they pass only once under or over the same; for weaker currents the conducting wire is bent several times under and over the needle, in the form of a flat coil, so as to multiply its effect, whence such arrangements are called "multiplicators," and their invention



Reflecting Galvanometer.

is due to the German physicist, Schweigger. Their sensitiveness is in proportion to the number of windings in the coil, which often amounts to many hundreds, and even thousands. Of course in such cases the wire is very thin and provided with an isolating covering; the instrument is only used to ascertain the existence of very weak galvanic currents, and, if possible, measure their strength.

As that part of the current which in such coils goes over the needle runs in the opposite direction from that part which is under the needle, a compass needle, placed over a coil, must deviate in an opposite direction from the needle inside the coil; but if the needle over the coil has its poles in opposite directions, it will deviate in the same way as the other needle. Nobili made use of this for constructing a very sensitive galvanometer, by connecting two such needles with a rod. As they never have the same strength, the weaker will be compelled by the stronger to point with its north pole south, but will at the same time weaken the tendency of the other to point to the north pole, so that the combined system will be more easily deviated from the magnetic meridian. Such a system of two needles is called an "astatic galvanometer," and is largely used.

In order to ascertain very weak waves of a current, so minute as to be unable to move such an astatic needle system any perceptible degree, Poggendorff has attached a small reflecting mirror to them, which reflects the light of a lamp upon a screen, when the very least motion of the needle and mirror will cause a very perceptible motion of the luminous spot upon the wall or screen.

The adjoined engraving represents such a reflecting galvanometer, as constructed by Weber in Germany and Thomson in England. The instrument is seen at the right, and consists of a box containing a double coil, the astatic needle arrangement, with the reflecting mirror; on top is a curved magnetic bar, which, in conjunction with terrestrial magnetism, serves to place the needles in the desired directions, and causes them to be still more easily deviated by the weakest currents. At the left the screen and the lamp are seen. The light of the latter shines through a narrow slit, and is reflected back by the mirror attached to the needles, forming a light spot on the back of the screen, and by the least deviation of the needles the light spot moves to the right or left.

This instrument is essentially the same as that used for working the Atlantic cable telegraph, and which we illustrated and described ten years ago on page 257 of our September number for 1869. Since that time the instrument has become a regular tool in the physical cabinets, and the one we here represent is that found in the Stevens Technological Institute in Hoboken, where it is used for refined researches and the determination of high resistances, such as those of glass, gutta-percha, and similar so-called isolating substances—we say so-called, as there are no perfect isolaters for electricity, except the absolute vacuum, which the strongest current cannot pierce.

The Introduction of Water Meters in New York City.

From time to time the danger of a water famine in the city of New York has been brought to the notice of the public, and economy of consumption urged. These appeals have, in general, been of little avail. Taking advantage of a law framed for the purpose of controlling this evil, the Commissioner of Public Works has lately served a peremtory notice on a large number of water consumers, directing them "within twenty days from the receipt or service of this notice, to place a Worthington water meter on the pipe supplying your premises with water, and thereafter to pay for water consumed according to measurement." Parties thus notified have the option of putting in the meter themselves or allowing the work to be done by the Department of Public Works; and in case of refusal to pay the water rates charged, the supply of water will be cut off. Mr. Birdsall, who has charge of the engineering department, states that this course is adopted to prevent the enormous waste. To illustrate the effects of economy, reference was made by this official to the great Third avenue horse-car stables, where the introduction of meters reduced the consumption immediately from 51,000 gallons per day to 15,000 or 16,000 gallons as at present. In seeking to check the extravagant use of water, the largest consumers are given attention first; accordingly, those now notified comprise three classes, namely, hotels, breweries, and slaughter houses. The large manufacturers and others will be served in turn, although a number of gas companies and sugar houses were compelled to use meters when the law requiring their adoption was first passed. About two years ago 90 water meters were placed on the docks for the use of shipping, and 120 more were put in stables, so that now there are about 600 of them in use altogether. The object is simply to carry out the requirements of the law under the charters of 1870 and 1873.

Mr. Birdsall explains that in 1871, when a contract was entered into for the manufacture and delivery of 10,000 of the Navarro meters at $70 each, only 4,000 were actually received, the commissioners deciding to reject them until they were compelled by a *mandamus* to do otherwise, and they have since resisted payment for those made. In 1876 the commissioners approved the Worthington water meter, but consumers are not altogether satisfied with the arbitrary choice made in their behalf, and litigation is threatened.

The charge where meters are introduced is 15 cents per 100 cubic feet, or, say 2 cents for every 100 gallons. The department says that the average consumption for each house is 1,000 gallons per day, even in the "high-service districts," where the dwellings are nearly all private. But there is no authority to compel the use of meters in private dwellings; they are put into such only by request, when an extraordinary use of water is demanded and the cost is not considered.

Scientific.

Another Step Toward the Million-Dollar Telescope.—Some seven years ago we proposed in this journal that a million-dollar telescope should be built. We suggested that the government spent millions upon millions to build iron-clads, monster guns, and monitors, and why could not a single million be appropriated for a purpose the realization of which would throw all former discoveries in the shade.

Other journals took the matter up and approved of the idea; the *Scientific American* especially made itself meritorious by an able defence of the proposition, which had been attacked by some astronomers as preposterous; and when we had the hardihood to propose it at one of the meetings of the American Association for the Advancement of Science, some of the members pronounced it absurd, asserting that to go beyond $30,000 was ridiculous—it could not be done; it was also said that the bold enterprise of Alvin Clark undertaking to make a $50,000 telescope (then in course of construction) was a doubtful enterprise, likely to end in failure, and if successful, it would be the limit of possibilities. We contended that it was only a matter of money—that if the money were forthcoming, we would have the talent to do it. The $50,000 telescope, with an object glass of 26 inches diameter, was finished, and its grand success is well known. Had it only been placed in a better position than in the swampy, foggy surroundings of Washington, still greater discoveries than the moons of Mars would have resulted.

At present Alvin Clark is making a similar telescope for Chicago, which will be even to a small degree superior; while last winter we informed our readers that in France, by a subscription, one million francs had been raised to build a telescope for the special purpose of settling the question as to whether the moon is inhabited or not. Well informed people do not believe in the existence of moon people, but such a telescope would set all doubts at rest forever.

Now comes the report that the great Russian astronomer, Otto Struve, from the famous observatory of Pulkowa, has come to the United States to order a telescope from Alvin Clark, which is to be so large that it will not only surpass any now in existence, but place Russia at the head of all other nations "for all time to come." The latter expression, which we copy from newspaper reports, we think rather too strong, because, seeing the immense progress continually being made in all branches of science and art, no one can tell whether, in later years, new discoveries from unexpected quarters may not make it possible to excel even the best results that can now be obtained by the greatest telescope builder in the world—Alvin Clark, of Cambridge, Mass.

It is indeed a great honor for the United States that one of its artisans should have been selected by the government of one of the greatest nations—a government that has always been equal, or superior, to the proudest among governments in advancing science by liberal patronage.

This telescope will be refracting and its objective lens of 36 inches diameter if possible. The flint glass is to be cast in Paris, as it is a work of great care and requires immense experience and preparation, so as to have it free from any flaw, the least of which would render it useless.

It is said that the Clarks would prefer to make a 30-inch objective first, so as to profit by the experience thus gained, it being an enormous step from 26 to 36 inches. Persons not familiar with the difficulties of the undertaking, should remember that, next to the perfection of the glass itself, all depends on the perfection of the curvature, and that the difficulties of attaining this perfection increase enormously with the size, becoming for such large lenses a question of years of labor and experiment, combined with considerable risk.

Since the above was written we have heard of further details in regard to the new telescope, which are embodied in the following article.

The New Americo-Russian Telescope.—A contract has been signed between Alvan Clark, of Cambridge, Mass., and Otto Struve, of Pulkowa, Russia, by which the former agrees to construct a telescopic achromatic object lens of 30 inches diameter for the sum of $32,000. Two years are allowed to procure the glass and eighteen months more to grind it. The mounting of the objective will be done in Europe, and with the metal work, the tube, eye-pieces, etc., will cost another $32,000. If to this is added the expense of stand, graduated circles, and of clock-work to move the telescope so as to follow the motion of the heavenly body under observation, the whole cost will be about $100,000—considerably less than we expected when we saw it announced that Russia wanted, by this purchase, to be at the head of astronomical science for all time to come. Even if the instrument ordered had much larger dimensions, the expectation to be placed at the head "for all time to come" is rather too sanguine, because experience has shown, especially in scientific matters, that we are never justified, in whatever branch we have achieved great success, to expect that we cannot be surpassed in the future; investigations in cognate branches have often given the means to overcome obstacles previously considered insurmountable.

At the recent meeting of the members of the American Association for the Advancement of Science, at Saratoga, N. Y., we had the pleasure of forming the acquaintance of the eminent Russian astronomer, and he informed us that his great desire was to have a lens of 36 inches diameter. But Mr. Clark did not dare to undertake it, chiefly by reason of the great difficulty in procuring a flint glass of such dimensions which would be homogeneous and entirely free from striæ, the least trace of which is most fatal for telescopic objectives, while the presence of a few small air bubbles is of little consequence. The largest lens thus far successfully cast was 28 inches in diameter; this was for Grubb in Dublin, but he has not yet succeeded in grinding it to a satisfactory curve, meeting with practical difficulties which are greater than he expected, while, according to reports, his prospects are far from favorable. It was intended for a telescope in the imperial observatory at Vienna, Austria.

We hope that Mr. Clark will be successful in procuring a good lens of 30 inches, surpassing by 2 inches the lens which Grubb in Dublin has not yet succeeded in finishing.

One of the difficulties to which large lenses are subject, is a distortion of their curvature by their own weight; this, of course, has an influence on their refractive qualities; they must therefore be thick enough to resist such distortion. A slight amount of reasoning will show that for reflecting objectives (mirrors) such distortion of the curve must have a far more disturbing influence than for refracting lenses through which the light passes; and this is the principal cause of the inferiority of reflecting telescopes, with which rarely any important discoveries have been made, except by their makers, such as the two Herschels, Lord Rosse, De la Rue, and others. This reflecting surface requires constant care and frequent renewal, not being at all permanent, like a good lens, hence the signal failures of the great reflecting telescopes of Leyden, Paris, and Melbourne. Then such telescopes, when large, are very ponderous and unwieldy, and cannot be mounted equatorially so as to follow, by means of clock-work, the motions of the firmament.

Our Washington telescope, of 26 inches, has already done good work, such as the discovery of two satellites of Mars, observations upon the satellites of Saturn, Uranus and Neptune, upon nebulæ, double stars, etc., and this to such an extent as to prove that any observatory which would not be left entirely in the rear, must be furnished with equal, or, if possible, better instruments.

We will close by giving a curious scientific incident in relation to telescopes. The objective of the telescope at present in the Pulkowa observatory, of 15 inches diameter, has a defect of interior reflection between the lenses, which led Prof. Struve to suppose that he had discovered a very small companion star to the bright Procyon. Prof. Weisse, of the Vienna observatory, was in the United States at the time this discovery was published, and tried to find this companion star by aid of the telescopes at that time existing here; not finding it, he concluded that our makers were incompetent, and he did not order the new telescope here, as he first intended, but ordered it from Grubb in Dublin. As above stated, Grubb has not finished it yet, and probably never will. Prof. Struve, since discovering that the supposed companion to Procyon was a ghost in his telescope, came to the conclusion that the reason why the American telescopes did not show it, was the absence in them of such misleading defects. In addition to this came the failure of Grubb to fulfill his contract, and the result was a resolution to entrust the enterprise to our great American telescope maker, who has demonstrated what he can do.

Atmospheric Electricity and Plant Life.—According to M. Grandeau, atmospheric electricity is a powerful agent in the process of assimilation among vegetables. He says that plants defended from its influence have built up 50 or 60 per cent less of nitrogenized matter than those exposed to ordinary conditions. The proportion of ash is higher, and that of water lower, in plants sheltered from the action of atmospheric electricity. The electric screen enclosing the plants experimented on was formed of four triangles of iron. The plants were maize, tobacco and wheat; all other conditions were the same, but of the two specimens pitted against each other, one was screened from atmospheric electricity and the other was not. The plants, after being allowed to grow for several months, were then measured, weighed and analyzed. All the experiments exemplify the above percentage in the most striking manner. The plants tested are tall, but low growing plants are equally influenced by atmospheric electricity. This fact may help to explain the absence of herbs under certain trees. It should also be mentioned that the total development of the plant is proportional to that of the nitrogenized matter under normal conditions. M. Berthelot, in a subsequent note to the French Academy on this subject, draws attention to the discovery made by him that free nitrogen united itself to organic matter under the action of electric currents not only from ordinary induction coils, but from feeble voltaic batteries; for example, five Leclanche cells; the proportion of nitrogen thus fixed in seven months on paper and dextrine being 1.92 thousandths, which will represent about 1.2 hundredths of matter analogous to the nitrogenized compounds of vegetables. It would thus appear that the slow, continuous action of feeble atmospheric currents on vegetation has a far more important bearing on agriculture than the formation of nitrous and nitric acid with their ammoniacal salts by the violence of the lightning's flash.

Hemocyanine.—M. Fredericq has been for a long time occupied at the Zoölogical Laboratory at Roscoff, on the coast of Brittany, in studying the circulating fluid in the cephalopods, and more particularly the cuttle-fish. He has discovered that the blood contains a substance new to science, to which he has given the name Hemocyanine, formed from two Green words, signifying blood and blue. The liquid part of the circulating fluid of the pulpi contains a colorless albuminoid substance, forming with oxygen an unstable combination which is of a deep blue color. When placed under a vacuum, or in contact with living tissues, or preserved in a closed vessel, it gives off the oxygen and becomes colorless. That substance plays, in the respiration of the cuttle-fish, the same part that the hamoglobine (the coloring globule of the blood) does in the vertebrate animals. It absorbs oxygen in the bronchial tubes of the pulpi, and then passing into the arterial system of the animal, gives up that oxygen to the tissues. The venous blood of the creature is colorless,

and the changes are dependent on the respiration. A series of experiments showed that this substance is the only albuminoid matter contained in the blood, for if heated to 154° Fah. it becomes opalescent, and coagulates at 156° Fah., giving a precipitate of bluish flakes and a perfectly clear and colorless liquid, which undergoes no further change either from heat, alcohol or ether. When the deposit is evaporated at a low temperature, the result is a blue, brilliant substance, having the aspect of gelatin. When burned, it gives off a smell of calcined horn, and leaves a rich residue of copper, which is so abundant that the merest assay with the blow-pipe suffices to produce it. The conclusion M. Fredericq draws is the curious fact that, in these lower animals, copper plays the same part in their circulating fluid that iron does in our blood. He has not as yet been able to determine the exact proportion of copper, but he is experimenting in that direction.

Samarium, a Newly Discovered Element.—Spectroscopic investigation has given us the knowledge of the existence of another new metal. M. Lecoq de Boisbaudran, who discovered gallium, (see pages 134 and 159 of our June and July numbers), was examining the flame of the mineral known as samachite, by means of the spectroscope, when he found in the same lines which could not be referred to any other known element; he concludes, therefore that they are due to an as yet unknown metal, which he has called Samarium. He has not yet succeeded in isolating it, but no doubt this will be done in time, as has been the case with rubidium, caesium, thallium, indium, gallium, phillipium, and scandium.

Norwegium, Another New Element.—Prof. Telleff-Dahl, of the University of Norway, has discovered in a metallic compound consisting of arsenic and nickel, a new metal, which he names after his fatherland—Norwegium. He has already gone further than the discoverer of Samarium, and isolated the same. He finds it to be almost as white as silver, hard as copper, slightly malleable, and fusible a little below 800° Fah. He finds its specific gravity a little less than silver, namely, 9.44, and has determined its chemical equivalent to be 145; it is therefore one of the heavy metals, and will no doubt fill one of the gaps existing in the groups into which modern chemistry divides them.

Still another new elementary substance is suspected by Prof. Koenig, of Philadelphia, to which however he has given no name, (see page 183 of our August number).

Resistance and Illuminating Power of the Electric Arc.—Professors Elihu Thomson and Edwin J. Houston, of Philadelphia, publish in the *Journal of the Franklin Institute* the results of some experiments on the resistance and illuminating power of the electric arc. According to them, the relations existing between arc resistance and current strength, and between current strength and illuminating power, are, within a certain range of conditions, apparently expressed by the following laws: 1st. In arcs of equal lengths the resistances are inversely proportional to the current strengths. 2d. The illuminating power of an arc is approximately proportional to the current traversing it. 3d. In arcs of equal length, the total energy given out is proportional to the current strength.

The Atmospheric Carbon-Dioxid.

How different scientific views may lead to opposite conclusions, was illustrated a short time ago in regard to the question whether carbon-dioxid (or carbonic acid, as it used to be called) is increasing or diminishing in our atmosphere. The editor of this journal concluded that it was increasing, seeing the steady expansion of the coal mining interest, and the enormous amount of this gas poured into the atmosphere by the thousands of furnaces under steam boilers and in smelting works. Many volcanoes, grottos, and springs also pour carbon-dioxid into the atmosphere, not to speak of the almost continual production of carbon-dioxid all over the world by the wants of mankind for cooking, heating and lighting purposes, it being understood that the subtraction of carbonic acid by vegetation is counterbalanced by its production by breathing animals.

At the same time that the editor published this opinion, the eminent chemist, Prof. Wurtz, of Hoboken, N. J., published contrary views. He considered chiefly the fact that the coral building animals and the shell fish, in subtracting the lime dissolved in the sea-water, could not build it up into these solid formations without changing it into a carbonate, and that for this purpose they continually subtracted carbon-dioxid from the water also, which, in its turn could only obtain the thus continually exhausting supply from the atmosphere. He considered that the free lime dissolved in sea-water and supplied by rivers, was continually combining with the carbon-dioxid and also precipitating deposits of limestone, to a great extent assisted by the microscopic calcareous shells of the animalcula forming the chalk beds; hence recent investigators, while finding how the ocean is still forming large deposits of chalk cliffs and lime rocks, exclaimed, "We still live in the cretaceous period." Prof. Wurtz's, for these and some other reasons, came to the conclusion that the amount of carbonic acid was still continually diminishing, and found further support for this opinion in the fact—well established by geology—that in bygone ages our atmosphere was very rich in this gas, far richer than at present, and that part of it was deposited in the gigantic mountain ranges as lime rock and marble; another part destroyed by vegetation, so that the carbon was finally deposited as coal and its oxygen given to the atmosphere; and again another part deposited as carbonate of lime in the coral reefs. Finally, he concluded that this process of diminution of carbon-dioxid goes on to the present day, and that when the air has become deprived of its last small amount, vegetation will, from necessity, come to an end.

These conflicting conclusions naturally led to much thought, and the editor finally came to the conviction that our atmosphere is only a part of the general planetary atmosphere filling the whole range of our planetary system, while each planet condenses as much of it around it as it is capable of doing by its power of gravitating attraction, so that the very large planets, such as Jupiter, will have very deep atmospheres, and the sun the deepest of all, while bodies the size of the moon will scarcely have any appreciable atmosphere at all. Spectroscopic researches confirm all these conclusions.

If we accept this view, it is clear that any local excesses or deficiencies of the same constituents, will, by the law of gaseous diffusion, spread themselves indefinitely, and a general equalization will be the result, which will affect every part of space, while at the same time this highly attenuated atmosphere will take the place of the resistant but purely hypothetical ethereal medium, which resists the motions of planets and propagates heat and light.

But we need go no further in our explanation of this hypothesis, as it has been so ably set forth by Prof. T. Sterry Hunt in the preface to a new edition of his "Chemical and Geological Essays," an advance copy of which he had the kindness to send us. The views are so interesting, and at the same time sound, that we cannot refrain from taking an extract from the book for the benefit of those of our readers who love research as to the true causes of natural events. Prof. Hunt says:

"From the great amount of carbon and hydro-carbons of organic origin found in the rocky strata of the earth, it has long been inferred that the atmosphere of earlier times must have contained a large quantity of carbonic-dioxid, which yielded up its carbon for the nutrition of the ancient floras. From this the late Major Edwin B. Hunt concluded that the atmosphere in former periods, being much denser than at present, the temperature at the earth's surface, due to solar radiation, would be greater than now. It was subsequently pointed out by the present writer that, as already shown by Tyndall, the relations of carbonic-dioxid to radiant heat are such that a quantity of this gas, too small to affect considerably the weight of the atmospheric column, would, by preventing the loss of heat, suffice to produce a tropical temperature over the earth at the sea level.

"The quantity of carbon that has been removed from the air by vegetation in past ages is, however, very considerable. In a communication by the writer to the American Association for the Advancement of Science, at Buffalo, in 1866, it was stated that the whole amount of free oxygen in the present atmosphere is no more than sufficient to form carbonic-dioxid with the carbon of a layer of coal covering the globe one meter in thickness, and that the aggregate of carbonaceous matter in the earth's crust would probably much exceed this. Such a layer of coal, of a specific gravity of 1.25, would have a weight equal to 3,160,000 gross tons to the square mile, while Mr. J. L. Mott, in a communication to the British Association for the Advancement of Science, in 1877, estimates the total amount of carbonaceous substances in the earth at not less than 3,000,000 tons of carbon to the square mile, and probably many times greater. This minimum amount of pure carbon is equal to 600 times the present amount of carbonic-dioxid in the atmosphere, or to nearly one-fourth its entire volume; and, inasmuch as the fixation of carbon by vegetation liberates a corresponding volume of oxygen, would represent, according to him, a greater amount of this gas than the present atmosphere contains. In addition to this, it must be considered that the composition of the various hydro-carbonaceous minerals shows a deoxidation not only of carbonic-dioxid, but of water. The amount of liberated oxygen derived from water equals, for the various coals and asphalts, from one-eighth to one-fourth, and for the petroleums one-half of that set free in the deoxidation of the carbon which these hydro-carbonaceous bodies contain. To this must be added also the oxygen set free in the generation of metallic sulphids by the deoxidation of sulphates, which is effected through the agency of organic matters, and indirectly liberates oxygen. Against this, however, we must set the unknown but very considerable amount of oxygen absorbed in the peroxidation of ferrous oxid liberated in the decay of the silicates of crystalline rocks, which may perhaps serve to explain the disappearance from the air of the whole of this excess of oxygen.

"The terrestrial vegetation and the air-breathing fauna, which we find from paleozoic ages, are, it is unnecessary to remark, incompatible with an atmosphere holding one-fourth its volume of carbonic-dioxid, and the difficulty of the problem is greatly increased when we consider that this amount, corresponding to the carbon fixed in the earth's crust in deoxidized forms, is insignificant when compared with that which has been absorbed during the decomposition of silicated rocks, and is now fixed in the form of limestones. The magnitude of this process is seen when we consider that all the argillaceous rocks and clays of the stratified formations have come from the decay of the feldspars and other silicates of the earlier eozoic terranes through the intervention of carbonic-dioxid, and that the resulting alkaline and earthy carbonates are now represented by the limestones so abundant in the earth's crust. It is shown, in the author's communication already quoted, that a layer of pure limestone covering the earth's surface to a depth of about 28 feet (8.61 meters) corresponds to an amount of carbonic-dioxid, which, if set free, would double the weight of the present atmosphere, and the existence of great limestone and dolomite formations, many hundred feet in thickness, at different geological horizons over wide areas, will, it is believed, justify the conclusion that the earth's crust contains, fixed in the form of carbonates, an amount of carbonic-dioxid, which, if liberated in a gaseous form, would be equal in weight to at least two hundred atmospheres like the present one. A portion of this carbonic acid was doubtless separated at an early period in the history of our globe, since the limestones of the eozoic rocks are of considerable thickness, and those of more recent times are in part derived from the solution and re-deposition of the older limestones."

Punching and Shearing by Foot-Power.

Many manufacturers no doubt have long felt the want of a punching press that could be worked as easily as a foot lathe, and still punch holes of say ¼ of an inch in ¼-inch sheet iron or metal. Thus far only machines driven by power have performed such labor, or if occasionally a hand-power press for this purpose was constructed, it operated with a very long lever, usually requiring two men to work it, and operating very slowly at that.

In power presses a fly-wheel is usually employed to store up the power, either for punching or shearing. This however is objectionable when using foot-power, and it was a happy idea to substitute for the fly-wheel a heavily weighted pendulum, oscillated by a treadle worked by the foot, and so arranged that by a clutch, shaft and eccentric a power is obtained surpassing that of a drop hammer, but giving a gentle and at the same time an irresistable pressure, produced by the heavy weight with which the pendulum rod is charged, combined with its leverage acting upon an eccentric which works the striking frame carrying the punch, shear, or die, as these presses are just as well adapted for shearing and stamping as for punching.

The adjoined engravings represent three of the many forms in which these presses are now manufactured by the Peerless Punch and Shear Company, of 52 Dey street, New York. Fig. 1 represents one which can be worked by hand or foot; the lever to be worked by hand is shown by the dotted lines, and can be substituted for the treadle. This press is for comparatively light work, while Fig. 2 represents one still lighter; this lightness, however, is chiefly confined to the supporting legs, the working part being always sufficiently heavy to be fully reliable and able to stand the strain to which they may be submitted, while at the same time they are as finely finished as the best power presses in use.

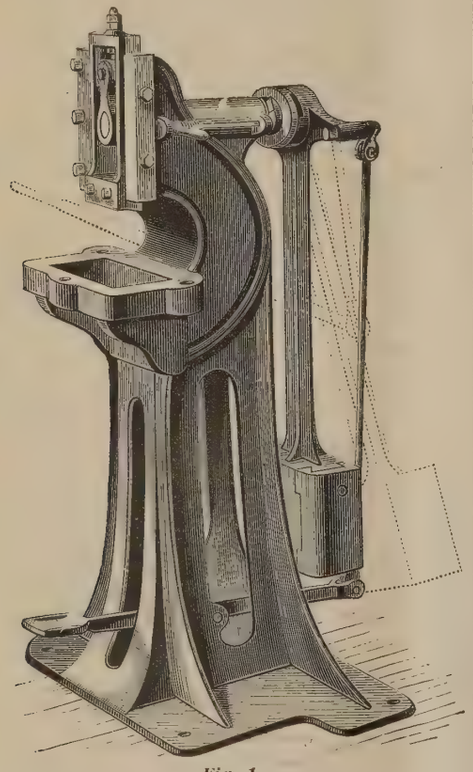


Fig. 1.

When these presses are intended for the heaviest work, they are made in the style represented by Fig. 3, in which the support of the moving part is double, while the pendulum, which is very heavily charged, is prolongated below the floor, in order to have it out of the way, but principally to be enabled to give it any desired length, so as to obtain the long leverage required for heavy work. It is evident, however, that this form does not give the space around the punch or shears that is afforded by the form Figs. 1 and 2, which are especially adapted for punching or shearing the edges of large plates, while Fig. 3 is especially suitable for bar iron.

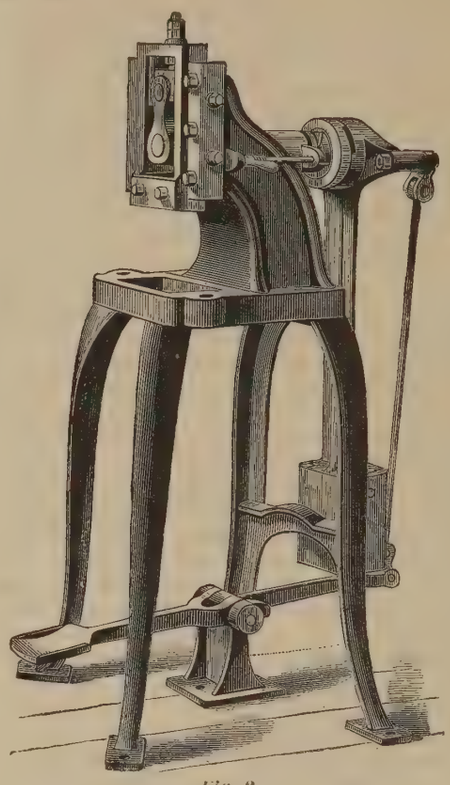


Fig. 2.

In the presses represented in Figs. 1 and 2 the pendulum may be made to swing all around, and thus act like a fly-wheel; this of course cannot be done with the form Fig. 3. This turning around is practiced when a great number of holes have to be punched in quick succession, possessing over a fly-wheel the advantage of having gravitation act in connection with the momentum. A fly-wheel being balanced all around has not this advantage of aid from gravitation. After the weight of the pendulum has reached the highest point, and is about to fall, a clutch, which acts automatically or otherwise, at the will of the operator, makes connection with the shaft and the eccentric, and the weight in falling uses the power obtained by its fall and drives the punch or shear through the iron. The cause of this effect, which surprises many on seeing it for the first time, is that the velocity of the weight, which, when falling say 6 feet, moves near the end of its fall at the rate of 12 feet per second, is in the punch reduced to a velocity of say ⅛ an inch per second; this gives an increase of pressure in the ratio of ⅛ an inch to 12 feet, or 288 times the weight of the pendulum; when the weight is say 200 pounds, the force driving the punch through will be nearly 30 tons. This shows forcibly the advantage of a pendulum over a fly-wheel. However, these machines are so made that a fly-wheel can be substituted for the pendulum in a few minutes, when it is desired.

In regard to the actual tests made with these machines, we can state that, with the press shown in Fig. 1, one man can punch, by foot with an ordinary flat punch, an inch hole through ¼ inch iron, ⅜-inch hole through $^5/_{16}$-inch iron, or a ⅝-inch hole through ⅜-inch iron; while with that shown in Fig. 2, 4x6 blanks can be punched out of No. 7 iron, or its equivalent of brass. These foot presses will also shear ¼-inch plate and ⅝-inch bar, and this as rapidly as any ordinary power press. With the hand-lever press, Fig. 3, when the full power of a man is employed to do the work, while another holds the iron, still heavier work can be done, such as shearing ⅝x2½-inch bar iron at a single cut, and punching an inch hole in ⅝ bar, any length.

The weights of the pendulum are made in removable sections, so that for light work the labor of swinging the pendulum may be made easier; while the levers of the treadle are jointed, so that they can be turned upward out of the way that the foot may not be caught under them.

We advise all interested to inspect the operation of these surprising tools, for their own satisfaction, at 52 Dey street, this city.

England's Awakening.

Bradford, England, which is the center of the wool manufacturing industry in that country, will shortly possess a $100,000 technical school. At a meeting of the trustees a few weeks since, the president made the significant admission that Bradford's only hope is in further increasing the variety of its products and in improving their quality and adaptability. The export business in mixed fabrics he scarcely expected would be kept up, as America in the future will take less and less of the low-priced goods formerly imported so largely from Bradford. To his knowledge some of the best artisans were leaving Bradford every week, and he believed a large portion of them were going to America to take charge of manufacturing establishments as overlookers and mechanics, where they received higher wages than they could obtain in England. There was no doubt, he thought, that American manufacturers were increasing their fabrics very considerably, and Bradford had but little to hope for from the United States in the way of admission for ordinary fabrics.

Telegraphing without Wires.—Prof. Loomis continues his experiments in the mountains of West Virginia, to demonstrate the theory that at certain elevations there is a natural electric current, by taking advantage of which telegraphic messages may be sent without the use of wires. It is said that he has telegraphed a distance of eleven miles by means of kites flown with copper wire. When the kites reached the same altitude, or got into the same current, communication by means of an instrument similar to that of Morse was easy, but ceased as soon as one of the kites was lowered. He has built towers on two hills about twenty miles apart, and from the tops of them has run up steel rods into the region of the electric current.

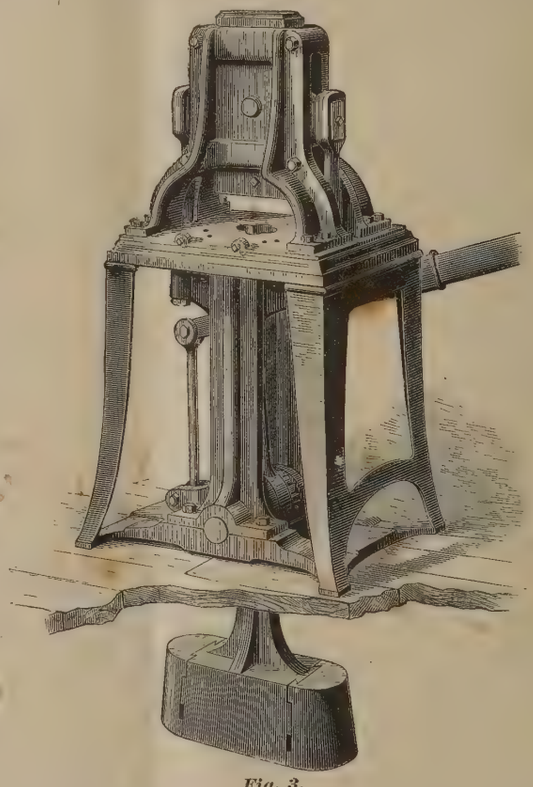


Fig. 3.

Latest Market Report of Building Materials.

NEW YORK PRICES.

ARTICLES MARKED WITH A STAR (*) ARE QUOTED IN GOLD.

—o—

LUMBER.

Pine, very choice and extra dry, per M	$55 00 @ 60 00
Pine, good	45 00 @ 50 00
Pine, shipping box	18 00 @ 22 00
Pine, common box	16 00 @ 17 00
Pine, common box, ⅝	13 00 @ 15 00
Pine, tally plank, 1¼, 10 inch, dressed, each	40 @ 43
Pine, tally plank, 1¼, 2d quality	35 @ 38
Pine, tally plank, 1¼, culls	25 @ 28
Pine, tally boards, dressed, good	28 @ 30
Pine, tally boards, dressed, common	22 @ 25
Pine, tally boards, culls, dressed	21 @ 23
Pine, strip boards, merchantable	16 @ 18
Pine, strip boards, clear	22 @ 25
Pine, strip plank, dressed, clear	33 @ 35
Spruce boards, dressed	18 @ 20
Spruce plank, 1¼-inch, dressed	22 @ 25
Spruce plank, 2-inch	28 @ 34
Spruce wall strips	13 @ — 15
Spruce timber, per M	16 00 @ 19 00
Hemlock boards, each	14 @ — 16
Hemlock joist, 2½x4	15 @ — 16
Hemlock joist, 3x4	16 @ — 18
Hemlock joist, 4x6	40 @ — 44
Ash, good, per M	30 00 @ 50 00
Oak	32 50 @ 65 00
Maple culls	20 00 @ 25 00
Maple good	45 00 @ 85 50
Chestnut	42 00 @ 48 00
Cypress, 1, 1½, 2, and 2½-inch	35 00 @ 40 00
Black walnut, good to choice	85 00 @100 00
Black walnut, ⅝-inch	75 00 @ 85 00
Black walnut, selected and seasoned	110 00 @150 00
Black walnut counters, per ft	12½ @ 20
Cherry, wide, per M	85 00 @100 00
Cherry, ordinary	60 00 @ 80 00
White wood, chair plank	60 00 @ 70 00
White wood, inch	25 00 @ 45 00
White wood, ⅝-inch	30 00 @ 45 00
White wood, ⅝ panels	35 00 @ 50 00
Shingles, extra sawed pine, 18-inch	5 00 @ 7 00
Shingles, clear sawed pine, 18-inch	4 00 @ 5 00
Shingles, cypress, 24x7	20 00 @ 22 00
Shingles, cypress, 20x6	12 00 @ 15 00
Lath, Cargo rate	1 40 @ — —
Yellow dressed pine flooring	25 00 @ 35 00
Yellow pine girders	30 00 @ 40 00
Locust posts, 8 feet, per inch	18 @ 20
Locust posts, 10 feet	24 @ 25
Locust posts, 12 feet	29 @ 34
Chestnut posts, per ft	3 @ 3½
Basswood per M	25 00 @ 30 00

Cargo rates, 10 per cent off.

BRICKS.

	Cargo.		Afloat.
Pale, per M.	3 75	@	4 00
Jersey	4 75	@	5 50
Up Rivers	5 00	@	5 50
Haverstraw Bay	5 50	@	5 75
" " choice	5 87	@	6 00
Favorite Brands	6 50	@	7 50
Hollow Fire-Clay Brick	9 00	@	9 25

FRONTS.

Croton—Brown, per M.	7 50	@	8 50
" Dark	8 50	@	9 50
" Red	9 00	@	9 50
Philadelphia	26 00	@	28 00
Trenton	24 00	@	29 00
Baltimore	34 00	@	38 00

Yard prices 50 cents per M higher, or with delivery added $2 per M for hard and $3 per M for front brick. For delivery add $5 on Philadelphia and Trenton, and $6 on Baltimore brick.

IRON—PER TON.

Duty.—Bar, 1 to 1½c. per lb.; Railroad, 70c. per 100 lbs.; Boiler and Plate, 1½c. per lb.; Sheet, Band, Hoop and Scroll, 1¼ to 1¾c. per lb.; Pig, $7 per ton; Polished Sheet, 3c. per lb.; Galvanized, 2½c. per lb.; Scrap Cast, $6 per ton; Scrap Wrought, $8 per ton—all less 10 per cent. No Bar Iron to pay a less duty than 35 per cent ad val.

Pig, Scotch—Coltness	26 00 @ 27 00
" Glengarnock	24 50 @ 25 00
" Eglinton	23 50 @ 24 00
" American, No. 1	25 00 @ 26 00
" American, No. 2	22 00 @ 24 00
" American, forge	20 00 @ 22 00

	Store prices.		Cash.
Bar, Swedes, ordinary sizes	— 5	@	— 5½
Bar, Swedes, nail-rod	— —	@	— 6

LEAD—PER 100 POUNDS.

*German	— —	@	— —
*English, common	— —	@	— —
*Spanish	— —	@	— —
*Foreign, refined	— —	@	— —
*Bar	5 00	@	— —
*Sheet and Pipe	5 00	@	6 00
*Domestic	3 37	@	— —

NAILS—PER KEG.

10d to 60d, common, fence and sheathing	2 30	@	— —
8d and 9d, common	2 85	@	— —
6d and 7d, common	3 10	@	— —
4d and 5d, common	3 35	@	— —
3d and 4d, light	4 10	@	— —
3d, fine	4 85	@	— —
2d, fine	4 85	@	— —
Cut spikes, all sizes	2 85	@	— —
Clinch nails, 1½ to 1¾ inch	5 00	@	5 25
do. 2 to 2¼ inch	4 75	@	— —
do. 2¼ to 2¾ inch	4 50	@	— —
do. 3 inch and longer	4 25	@	— —

TIN PLATES.—Duty, 1 1-10 cents per pound.

*I. C. charcoal, 10x14, per box	6 25	@	6 50
*I. C. coke, 10x14	5 00	@	5 75
*I. X. charcoal, 10x14	8 25	@	8 50
*I. C. charcoal, 14x20	6 25	@	6 50
*I. X. charcoal, 14x20	8 25	@	8 50
*I. C. coke, 14x20	5 00	@	5 75
*I. C. coke, terne, 14x20	5 00	@	5 25
*I. C. charcoal, terne, 14x20	5 50	@	6 00

ZINC.—Duty, sheet, per lb., 2½ cents.

Sheet, (cask) per lb	— 6⅞	@	— 7
Sheet, (open)	— 7½	@	— —

SOLDERS.

No. 1	— 9½	@	— 10½
No. 2	— 9	@	— —

STONE.—Cargo Rates.

Amherst Freestone, in rough, per cubic foot	— —	@	— 85
Berlin Freestone, in rough	— —	@	— 95
Berea Freestone, in rough	— —	@	— 75
Brown-Stone, Portland, Conn	1 25	@	1 50
Brown Stone, Belleville, N. J	1 00	@	1 50
Granite, rough	— 60	@	1 25
Canaan Marble	1 25	@	1 50
Dorchester, N.B., Stone, rough, per foot	— —	@	1 00

PAINTS.

*Carmine, American, per lb. gold	5 75	@	6 00
Chalk, per lb.	— 00¼	@	— 00¾
China Clay, per ton gold	20 00	@	22 00
Chrome yellow, dry, per pound	— 12½	@	— 28
Lead, red American, per pound	— 7	@	— 8
Lead, white American, pure, in oil	— 7	@	— 8½
Lead, white American, pure, dry	— 6¾	@	— 7¼
Lead, white English, pure, in oil gold	— 9½	@	— 10½
Litharge	— 7	@	— 8
*Ochre, Fr., dry, per 100 lbs	1 50	@	— —
Ochre, ground, in oil, per lb	— 6	@	— 15
Ochre, Vermont, per 100 lbs	— 75	@	1 00
*Orange Mineral, English gold	— 9½	@	— 10
Paris White, American	— 1¾	@	— 1½
Paris White, English, prime	— 1¾	@	— 2
Paris Green	— 15	@	— 28
Plumbago paint, patent, per lb	— —	@	— 25
Putty, per lb	— 1¾	@	— 2½
Spanish Brown, dry, per lb	— 1⅛	@	— 1¼
Spanish Brown, ground in oil, per lb	— 8	@	— 9
Venetian red, per cwt	1 75	@	2 00
*Vermilion, Chinese, per lb	— 80	@	— 90
*Vermilion, Trieste	— 70	@	— 80
*Vermilion, quicksilver, bags gold	— 52½	@	— 55
Vermilion, American, common	— 15	@	— 18
Whiting, per 100 lbs	— 50	@	— 80
Zinc, white American, dry, No. 1	— 5	@	— 7½
Zinc, white American, No. 1, in oil	— 8	@	— 10
*Zinc, white French, dry, (Red Seal,) gold	— 8	@	— 8¾
Zinc, white French, in oil gold	— 10	@	— 10½

VARNISHES—PER GALLON.

American Wearing Body	3 50	@	4 00
Coach Body	2 35	@	3 50
do do	1 80	@	2 00
Furniture	1 25	@	2 50
Black Asphaltum	1 00	@	1 50
Brown Japan	1 00	@	1 20
Liquid Paint Dryer	1 35	@	1 75
Harness, (black)	3 00	@	4 50
Shellac, Spirits	3 00	@	3 50

CEMENT—PER BARREL.

Portland (imported)	2 75	@	3 50
Portland (American)	2 50	@	2 75
Roman	2 75	@	3 25
Keene's, coarse	6 50	@	— —
" fine	10 50	@	— —
Martin's, coarse	6 00	@	— —
" fine	10 50	@	— —
Rosendale	— 90	@	1 00

DEADENING AND ROOFING MATERIAL.

Mineral Wool for Roofs and Deadening, per lb. — 1¼ @ — 1½

HAIR.

Cattle, per bushel of 7 lbs	— 9	@	— 12½
Goat, " "	— 15	@	— —

SLATE.

Purple roofing slate, per square	$6 00	@	7 00
Green slate	6 00	@	7 00
Red slate	10 00	@	11 00
Black slate, Pennsylvania, (at Jersey City)	5 00	@	5 25
" " Cargo rate	3 25	@	3 75
Slate tiles, 1¼-inch, rubbed, per square foot	20	@	— 25

PLASTER PARIS

Duty.—20 per cent ad. val. on calcined; lump free.

Nova Scotia, white, per ton	2 90	@	3 00
Nova Scotia, blue	2 80	@	2 85
Calcined, Eastern and city, per bbl	1 00	@	1 15
Calcined, city casting	1 20	@	1 25
Calcined, city superfine	1 30	@	1 50

LIME—PER BARREL.

State, common	— 75	@	— —
" finishing	— 85	@	— —
Rockland, common, cargo rate	— 60	@	— 65
" finishing	— 80	@	— 85
Ground	— 65	@	— 70

Add 25 cents to above figures for yard rates.

FOREIGN WOODS.

MAHOGANY.

St. Domingo, crotches, ordinary to good, per ft	— 15	@	— 20
St. Domingo, crotches, fine	— 20	@	— 30
St. Domingo, logs, small	— 5	@	— 8
St. Domingo, logs, large	— 20	@	— 30
Frontera, Mexican, large	— 11½	@	— 16
Frontera, Mexican, small	— 8	@	— 10
Other Mexican	— 8	@	— 14
Honduras	— 10	@	— 15

ROSEWOOD.

Rio Janeiro, ordinary to good, per lb	— 2½	@	— 8
Rio Janeiro, good to fine	— 5	@	— 8
Bahia, ordinary to good	— 2	@	— 6½
Bahia, good to fine	— 4½	@	— 8
Honduras, per ton	10 00	@	20 00
Satin Wood, per foot	— 15	@	— 60
Tulipwood, per lb	— 6	@	— 12½
Lignumvitæ, small, per ton	10 00	@	20 00
Lignumvitæ, large	25 00	@	50 00

CEDAR.

Cuba, per superficial foot	— 12½	@	— 16½
Mexican, small	— 8	@	— 10
Mexican, large	— 10	@	— 16
Florida	— 50	@	2 00

DOORS, WINDOWS, AND BLINDS.

DOORS, RAISED PANELS, TWO SIDES.

2.0 x 6.0	1¾ inch.	$ 67	—
2.6 x 6.6	1¾	— 95	—
2.6 x 6.8	1¾	— 99	—
2.8 x 6.8	1¾	1 04	—

DOORS, MOLDED.

Size.	1¼ inches.	1½ inches.	1¾ inches.
2.0 x 6.0	$1 23	—	—
2.6 x 6.6	1 52	1 93	—
2.6 x 6.8	1 57	1 85	—
2.6 x 6.10	1 59	2 01	—
2.6 x 7.0	1 62	2 09	—
2.8 x 6.8	1 62	2 09	2 57
2.8 x 7.0	1 69	3 17	2 69
2.10 x 6.10	1 79	2 26	2 84
3.0 x 7.0	1 87	2 45	3 00

INSIDE BLINDS.

Per lineal foot, 4 folds, pine	04	@	— —
Per lineal foot, 4 folds, ash or chestnut	— 07	@	— —
Per lineal foot, 4 folds, cherry or butternut	— 08	@	— —
Per lineal foot, 4 folds, black walnut	— 10	@	— —

OUTSIDE BLINDS.

Up to 2.10 wide, per lineal foot	—	@	—
Up to 3.1 wide	—	@	—
Up to 3.4 wide	—	@	—
Do. painted and trimmed	—	@	—

DRAIN AND SEWER PIPE.

(Delivered on board at New York.)

Discount 50 to 60 per cent, according to quality and size of order.

PIPE, per running foot.

2 inches diameter,	$0 13	10 inches diameter,	$0 70
3 "	0 16	12 "	0 80
4 "	0 20	15 "	1 25
5 "	0 25	18 "	1 60
6 "	0 30	20 "	2 00
7 "	0 35	22 "	2 50
8 "	0 45	24 "	3 00
9 "	0 55		

REVIEW OF THE MARKETS.—Quite an active demand has been reported by dealers in most of the markets under review, the past month, and business has got into a far better shape than for a long time past. Dealers therefore feel correspondingly cheerful, and we hear the most sanguine views expressed on all sides regarding the future of the markets. These predictions have, too, a firm basis upon which to rest; the improvement which has recently been witnessed is only what is being experienced in all other lines of business, and every indication denotes that we have at last entered upon that period of prosperity for which we have so long looked—a prosperity that will not only be lasting, but healthful.

THE MARKETS IN DETAIL.—In the lumber market the past month trade, both wholesale and retail, has been good. The demand has been largely local, with here and there new orders from distant points, as the progress of the season has admonished buyers to commence looking up supplies. The offerings have on the whole been quite equal to the outlet, with more stock within easy call if wanted. Quotations have, as a rule, been steady, and buyers have gained no permanent advantage.

In the brick market common hards have developed a somewhat slow sale, and values have declined to some extent, but there appears to have been reasonably good management in sending supplies forward, these not having reached an aggregate calculated to cause any great uneasiness.

In the lime market about former range of prices has continued, with no special change worthy of note.

In the lath market trade has not changed in any essential particular since our last, and we retain our former quotations.

In the hardware market an active and encouraging trade has been reported by most dealers, and the same cheerful tone prevails that we have for some time noted.

In the paint market a good business has been doing in a jobbing way. Prices have been uniform and well maintained on both domestic and foreign assortments of goods.

In the metal markets the principal feature has been the continued activity and advancing tendency of iron. Scotch pig of the best quality cannot be reached better than $27, and for No. 1 American $26 is asked, with offerings small, both for immediate and future delivery. Manufactured iron has been quite buoyant also, with a material addition made to cost on all the leading styles.

Copper, tin and tin plates have all been very firm, with an upward tendency.

GUARDING HUMAN LIFE.—During the ten years of work upon the Sutro Tunnel in Nevada, the lives of the operators have been carefully guarded, and but five or six deaths by accident have taken place. During the boring of the Hoosac Tunnel 185 men were killed, and the accidental deaths in the St. Gothard Tunnel have averaged one a day, while in the Comstock the average was one a week. The low rate of accidents in cutting the Sutro is attributed to the strict system under which the work has been carried on. The contempt which is bred of familiarity is the real cause of most explosions.

Smoothing and Polishing Wood.

We extract from the London *Engineering* a valuable article written by Mr. J. Richards, well known as an expert in wood-working machinery. It is especially interesting to us, as it shows that the merits of American inventors in this line of pursuit are freely recognized.

He begins by stating that the operations in preparing wood for joinery, cabinet work, or other purposes, when the surfaces are to be painted or varnished, consist in first cutting the wood to accurate dimensions, and then smoothing or polishing the surfaces. This last operation is called "cleaning off" or finishing, and often costs many times as much as shaping the wood to true dimensions.

For very hard or irregular grained wood, such as is made into veneers, or employed for the finer kinds of work, the cleaning off process consists first in planing the surfaces with a toothed plane, having a serrated edge like a comb, this tool scratching away the high places and levelling the surface without pulling or splintering the wood, as a common knife will do unless very carefully adjusted and worked. After tooth-planing, the surfaces are scraped with a steel hand scraper until the scratches made by the tooth-plane are removed, and the surface is then finished by rubbing with glass-paper of different finenesses.

Straight-grained hard woods can be cleaned off by planing with a common smoothing plane, and then scraping and rubbing them with glass-paper. Soft wood requires only careful planing and glass-papering, but if scraping is omitted great care must be taken in planing, or else the planing marks will show by reflection when the surface is polished, varnished or painted.

Cleaning off being an expensive process, there has naturally been much effort made to construct machines to take the place of hand-work, and the machinery is made to imitate hand operations. Cleaning off, for example, consisted of planing, scraping and sand-papering. The machines applied to the purpose are planing machines, scraping machines, and sand-papering machines. Planing machines which will produce a surface ready for sand-papering without scraping have been made, and are in common use for certain purposes, but as a rule the three old processes must be followed in the case of working hard or irregular grained wood.

In America, during recent years, there have been made quite a number of machines for planing or cleaning doors, the cutting cylinders being set diagonally to the course of the lumber. On the whole, however, it may be claimed that for the better class of work, and for hard woods, scraping is indispensable. More than twenty years ago Mr. B. D. Whitney, an American engineer well known for various inventions in wood converting, conceived the idea of applying scrapers by power, the edges of the scrapers being long enough to cut a shaving the whole width of the lumber at one operation. He began by preparing narrow machines, and gradually extending their width and capacity, adding one improvement after another, until a width of 32 inches was reached. At first the machines were worked on maple, walnut, and other native straight-grained woods, but the capacity of the machines, like their dimensions, was increased until the South American and other hard woods were treated successfully.

For twenty years this power scraping has been going on successfully, and from experiments witnessed by the writer, who has recently visited Mr. Whitney's works to examine into the matter, there seems to be nothing wanting to insure permanent success on hard woods of all kinds, including some kinds of veneers. To quote from a circular of the maker, "these are not planing machines, nor intended to take the place of planing machines, but are for smoothing or finishing hard wood surfaces, after such surfaces have been prepared on a planing machine, doing the work heretofore done only by hand labor, and in a more satisfactory manner and at much less expense."

With these machines the wood is smoothed by a blade having a turned edge like a hand scraper. This blade or scraper is held in a suitable stock, over which the lumber is fed by means of rollers. This stock or plane, as it may be called, is pressed against the bottom side of the lumber by means of springs, taking a thin shaving from the surface of the wood, leaving it glossy and perfectly smooth. The grain of the wood is not disturbed, and, after scraping the surface, is ready for varnishing without further treatment. This last statement will seem extraordinary to any one acquainted with wood-cutting, because of the difficulty of keeping knives of any kind in such order as to leave surfaces smooth enough for varnishing; it must be remembered, however, that the knife here employed is a scraper, and less liable to be nicked or injured by grit than one set as in a common planing machine.

In respect to sand-papering by machinery, the attempts have been many and more diversified, and there are many reasons for believing that, with improvements in the means for holding or carrying the abraiding sand or other material, much more can be accomplished than at the present time, not only in polishing and smoothing surfaces, but also in shaping the more friable kinds of woods.

In treating metals, for example, it is not long since emery was mounted or carried in the same manner that quartz or glass sand is now employed for wood working—that is, on belts, buffing wheels, or sheets of cloth or paper. Emery is now molded into solid wheels, cemented by glutinous or silicious substances, which do not materially interfere with the cutting action of the grains, and it is probable that with some research, such as has been devoted to making emery wheels for metal cutting, similar wheels of quartz or glass sand could be made for wood-cutting.

The history of the matter thus far, however, points to one difference, namely, that in all successful attempts to sand-paper by power, the plane of rotation of the polishing surfaces has been parallel to the face of the boards or pieces. We do not in this remark include what are called buffing wheels or cases, where light pieces are held on the periphery, and where such pieces are small enough to vibrate with any irregularities of the surface coated with sand; in other words, we refer to cases where, by reason of weight, or the mode of holding, the wood cannot yield, and is ground or cut away to positive dimensions.

In America the most successful type of machines has been those wherein a small disk of 10 or 12 inches diameter is faced with strong, specially prepared sand-paper. This disk, being mounted on a swinging frame, is moved irregularly over the surface of the wood by hand, as the roughness may require. The sand used is made from a species of quartz found in Nova Scotia, and the paper from manilla grass, with perhaps other fibrous material intermixed; two webs are joined together so as to cross the fiber and add strength. Fine, strong glue, which will so far as possible resist heat and moisture, must be used in fixing the quartz. For machine purposes this sand-paper is made in continuous webs or sheets of any size if specially ordered, so that taking into account the number of machines made, and the quantity of machine paper manufactured, there can be no doubt at this time of the permanent success of sand-polishing machines for wood-work.

Reciprocating machines for polishing wood moldings have also been tried, but with what success there is not at hand any definite information. Reciprocating movement—that is, rubbing backward and forward, as in hand work—is no doubt the most efficient way of using sand-paper, because all parts of the surface are worn alike, and the scratches or marks will generally be parallel with the grain; but machines to operate on this method are unsteady, and occupy a great deal of room.

Some Hints for Molders.—Experience has shown certain facts which may be useful to observe by molders, and to be adopted as rules in regard to preparing the running of the metal. Choose, if possible, the thickest part of the casting for the runner. If the casting be deep, run in the metal at the bottom. Where the casting has a flange in the form of a pipe, it is generally preferred to run the metal in at the flange; but the metal should not be allowed to fall from any hight upon a weak part of the mold. When the casting is thin, and has many branches, or when it is of great length, it is advisable to run in the metal in the center. Care should be taken to choose a place in the mold so that the metal will have no tendency to wash any part away in its first rush.

Water Gas as Fuel.

Apropos of the interesting discussion that has been going on recently as to the economic possibilities held out by the new water gas, (hydrogen and carbonic oxid), the *Engineering and Mining Journal* expresses the conviction that the time is near at hand when this new gas will come into general use, replacing coal for domestic purposes, in cities at least, and in many metallurgical operations. That journal now maintains that recent experiments have fully proven that enriched water gas is a cheaper and much better illuminant than coal-gas, but for purposes of illumination both methods will probably be superseded by the electric light.

As for the industrial application of the new process, the Swedish iron masters have been the first to thoroughly investigate the subject. They recently invited Mr. George S. Dwight, a well-known American metallurgist, to erect experimental works for the manufacture of water-gas by the "Strong process." These works afforded opportunity for making the most careful tests of the relative values of water gas, Siemens gas, and illuminating coal-gas, and of the adaptability of water-gas in many of the operations of iron manufacture. These experiments have induced eminent Swedish metallurgists to predict a revolution in the Swedish iron industry, from the advantage which the new system brings them. Large permanent works are now being erected in Sweden, and preparations are making for the adoption of the method in Russia and Germany.

The tendency towards the adoption of the new system in this country for illuminating purposes is quite marked. Already the gas companies in the cities of Scranton, Toronto, Yonkers, Baltimore, Phœnixville, Harrisburg, and several other places have adopted the new process.

We may add to this that one of the lately established gas companies in New York city, has from the first adopted this method, and has for some time been in very successful operation. It is the Municipal Gas Company, foot of 44th street, North River, where the works for the manufacture of water gas are constructed in the utmost perfection. In Brooklyn another water gas company has been established, which is now laying down its pipes.

The Holyoke Water Wheel Test.

The test announced in our August number to commence September 1st, at Holyoke, Mass., has twice been postponed, first to the 15th of September, and again to October 1st, at which latter date it was stated that the test would begin whether the parties had all arrived or not.

The testing flume has been enlarged and put in the best possible condition by the Water Power company, and is now by far the most perfect of the kind ever constructed. It is made of split granite 16 feet in width, 30 in depth, and 100 from weir to head gate, 25 feet of the upper end being used for the flume in which turbines are set to be tested. The pit is 7 feet in depth, standing water; the weir is 66 feet from center of turbine, and the width anywhere within 12 feet of the weir is something over 18 feet. The head can be changed from 1 to 18 feet, or the weir can be raised so that 8 feet of back-water can be placed upon the wheel. Improvements have been made by the company preparatory to making a variety of necessary experiments.

Home Department.

Bronze Ornaments.

The art of manufacturing bronze ornaments has of late years made enormous progress, as well in the beauty and adaptation of the various designs as in the lowering of the prices, which has been such as to place beautiful and elaborate designs within the reach of those who, in former years, could not aspire to the possession of such ornaments. This is the case with ornaments intended for churches as well as those intended for dwellings, and the introduction of gas into churches has been a strong stimulus to improve the old style of chandeliers and standards, formerly used for tallow candles, with which our fathers had to be satisfied, but are nowadays only found in villages and out-of-the-way towns.

Among the principal reformers in this comparatively new branch of industry is the Archer & Pancoast Manufacturing Co., of 67 Greene and 68, 70 and 72 Wooster streets, New York. Fig. 1 represents one of their nine-jet church standards, which have been introduced in a number of churches in this city and elsewhere, while Fig. 2 represents a newel post figure

Fig. 1.

for dwellings, very well adapted for the balustrades of staircases, mantel ornaments, etc.

Fig. 3 is a slide chandelier of very unique design. All these gas fixtures are usually plainly bronzed, but they may be had otherwise—for instance, colored in medieval style, or bronzed in various colors.

Fig. 4 is a crucifix, which it is ordinarily preferred to have silver or nickel plated; when silver-plated, it looks especially rich, and is a proper adornment for any Roman Catholic church or chapel.

We recommend all interested to call at the above mentioned establishment and examine the rich assortment of different objects of this and similar kinds.

Controlling the Temper.

The New York *Sun*, always sprightly, entertaining and, we believe, well-meaning, makes some apt remarks in regard to the ability of people with violent tempers to control themselves, and gives some sensible advice to a telegraph operator, who applies for a remedy to cure him of an unconquerable temper. Says the *Sun:*

"A man who has reached and passed maturity, and yet has not learned to control himself any more than a wilful child does, who has not put his passions under the dominion of his reason, and is likely to act without regard to consequences, is certainly a very unhappy individual, and a dangerous member of society. If his lack of self-restraint goes to extremes, we call him mad and shut him up in an insane asylum, or the law punishes him as a criminal. It is no more safe to let him go loose than it is safe to allow a wild beast to prowl about the streets. But there are many men who walk abroad freely whose passions are so illy regulated that they are always liable to do somebody an injury, and who are almost as much feared at home as a mad bull. You can't exactly prove them insane, and they may commit no violence which will compel their friends, jealous of their reputation, to get them locked up in jail, but they make miserable the lives of everybody

Fig. 2.

around them, and all under their power. Auburn and Sing Sing and the rest of the prisons by no means contain all the dangerous and blood-thirsty men, any more than they hold all of the thieves.

"A subscriber in New Jersey, who states that he is unmarried, confesses to us that he is one of these uncaged wild animals, and he asks us how he can tame himself.

"It is fortunate that our correspondent is not married,

Fig. 3.

for, having power over a wife and children, he might give further rein to his temper and make a very hell of his home. But it is a good sign that he recognizes his infirmity, and has a desire to cure it, as he may do by persistent effort. Perhaps, however, his brain is affected, and very likely it is. Such manifestations of violent and ungovernable temper as he describes are often symptoms of a progressive disease of the brain. A doctor, then, is the adviser for him to go to, and his state is one about which he may reasonably have much solicitude.

"But perhaps our correspondent is simply liable to outbursts of anger because he has never learned to control himself. Perhaps he runs wild because he has never put the halter on his passions. Very likely that is the case with him. If so, it is rather late in life for him to begin the work of restraint, which is one that ought to be done for everybody in childhood. But he can do it even now, if he puts forth the effort. If he doesn't make the effort, he ought to apply to the keeper of the State insane asylum to give him quarters, for a man of ungovernable temper ought not to be at large.

"But every sound man can govern his temper if he takes it in time. The way to stop a horse inclined to run away is to check and soothe him at the start, and so a man who feels his anger rising must at once get out of the influence of the irritating things and allow himself to cool off. When you feel that you are growing mad shut yourself up as an hysterical woman does—and you are not very different from her—and work out your passion in solitude. In fine, put yourself in chains until you are restored to reason.

"If you don't do this you will ultimately bring up in a madhouse or in a prison, and you will deserve the

Fig. 4.

fate, or have lapsed into a condition which will compel society to make it yours.

Useful Advice to Boarding-House Keepers.

A venerable lady who has kept boarders for twenty-five years, and declares that she has made money, and at the same time satisfied her boarders, says that one of the principal things is to have a good grindstone so as always to keep the knives very sharp. She says, give a boarder a sharp knife and a tough steak, such as a neck piece, and he will never make complaint, but put the blame on his teeth; and the more pieces of steak he leaves on his plate, the more meat you will have for hash.

The next thing is not to buy too good butter; it will tempt the boarders to eat five or six biscuits, or half a loaf of bread. Have tolerable good butter at breakfast when there is little else but toast, and let the boarders get along with old butter at the other meals.

Do not waste money for spring lamb. I can cook a neck piece of mutton so that it will look like a rib-roast, and with a little extra fire I make it just as tender, and I have often been complimented on my selection of choice spring lamb when it was mutton six years old, and the toughest part at that.

Then the idea of buying spring chickens for boarders is absurd—nay, it is wasteful, ruinous and wicked. I take a tough old rooster, pound him with a potato-masher for full ten minutes, cook him, set him before my boarders, and they have a feast that makes their hearts rejoice. An able landlady must be capable of baking a pig's head and slicing off the meat in such a manner

as to make every boarder believe that he has the choicest cut of the whole pig.

The trouble is that most boarding-house keepers do not know how to plan—it is all in the planning No wonder that so many are unsuccessful; they waste too good vituals on their boarders. So says the venerable landlady.

The Fair of the American Institute.

Following the example of previous exhibitions, the American Institute Fair opened this year long before the exhibits were in place, and the consequence has been the usual confusion and disorder until the present time, when the arrangements are about completed.

There are quite a number of interesting exhibits shown, but none that are particularly new. A very fine display is made by George Hayes, of this city, who exhibits his well-known skylights and ventilating appliances. Austin, Obdyke & Co., of Philadelphia, show their celebrated expanding corrugated conductors. S. J. Pardessus & Co., of this city, display various sizes of their glass dome skylights. There is a good display of wood-working machinery, and among the prominent exhibitors in this line we notice Witherby, Rugg & Richardson, of Worcester, Mass.; the Miller's Falls Company, J. H. Blaisdell, and Jas. T. Pratt & Co., of this city; Walker Brothers, of Philadelphia; John A. White & Co., of Concord, N. H.; and the H. B. Smith Machine Co., of Smithville, N. J. Among other exhibitors are the Pierce Well Excavator Co., who show their excavator; the Blake Crusher Co., who display two of their crushers; a crusher is also exhibited by the Farrel Foundry & Machine Co., of Ansonia, Conn. A machine for making bedsteads is shown by A. G. Betts, of Troy, N. Y. A. & F. Brown, of this city, exhibit two sizes of their hot-air engines. Winter's system of furnishing compressed air to tramways is shown. W. C. Duyckinck, of this city, exhibits machinists' tools, steel wheelbarrows, lifting jacks, air and vacuum gauges, universal lathe dogs, etc.; John H. Coleman exhibits a novelty in the form of a self-measuring tank for oils and other liquids, while the Niagara Steam Pump Works, of Brooklyn, N. Y., show their celebrated Hardick pumps. Other exhibits of interest will be reviewed in our November number.

A Serial Design.

We are promised a novelty, and one that will prove a useful one, by Mr. F. T. Camp, architect, of 206 West Thirty-third street, New York, in the shape of a serial cottage, so planned that at first the nucleus, or "baby cottage," may be erected, looking perfect in itself; the second illustration will show the "married cottage," or the nucleus with an addition, so planned still as to look as if it had always been just so; the third illustration showing a further enlargement, and called the "old folks' home," the same idea of completeness, and not suggestive of additions, being extended to this point, but no further. The *rationale* of this method of procedure may be found in the desirability of some design being found which will be complete in itself at any stage of the building, either as a small cottage for the young couple, the larger one for a growing family, and the homestead where the now grown members are always welcome and expected guests.

We are sure that this contribution will be hailed with delight by all our readers, as supplying a real want.

From the American Agriculturist, April, 1879.

Asbestos Liquid Paints.

These paints, made by the H. W. Johns Manufacturing Company, have in a remarkably short time attained a position that could not have been possible without real merit. When the Company received the contract to supply paint to cover the entire structure of the Metropolitan Elevated Railroad, the extent of the order was a matter of remark. Since then, the Company have made a contract for all the white paint to be used, inside and out, upon that immense pile, the United States Capitol at Washington, and, if we mistake not, the other Goverment buildings. The magnitude of this order should not be a source of so much satisfaction to the H. W. Johns M'f'g. Co. as the fact that it was made at all. Those who know the thorough investigation that is made by the engineers in charge of the public buildings appreciate that this is indeed a high indorsement of the paint. The Asbestos Paint is used upon another structure, which, though not so extended as the Elevated Railroad, or so prominent as the United States Capitol, is to the writer of far more importance than either—his own barn. It takes precedence of either of those in the fact that it was painted first. When the paint was applied, it was a comparative novelty. We noticed then the ease of application and its covering qualities. Now, at the end of two years, we find the surface remarkably hard and glossy, and it shows every indication of wearing in a most satisfactory manner. The fact that it is furnished in a great variety of pleasing tints, and in a condition ready to be applied at once, will lead those intending to paint to look into its merits.

Eastern Roofing Slates.—Under this name a very lasting roofing slate has been introduced into the market. It is quarried in Monson and Brownville, Me., and the samples we lately examined at Piper's wharf, 474 Atlantic avenue, Boston, showed the superior quality in regard to resistance to atmospheric influences. The prevailing color is a very dark bluish gray, with a gloss like graphite, which gloss is chiefly due to finely divided mica. As the latter substance is very fire-proof, this slate is also superior in regard to resisting fire, and will even stand a very intense heat, without disintegrating. It is offered in sizes from 10 × 6 up to 24 × 14 inches.

Miscellaneous and Advertising.

The Industrial Exhibition that was to have been held at Moscow this year, has been postponed until 1881, owing to the great depression in trade.

Rupture bands made to order. Single, $2.25; double, $3.50. Best material and workmanship. Send for circular. L. F. de Lesdernier & Co., 166 Greenwich street, New York.

The contract for the pumping machinery for the proposed new water works at Monticello, Iowa, has been let to the George F. Blake Manufacturing Co., of this city and Boston, for $1,200.

A first-class Blaisdell molder, and a large variety of all kinds of iron and wood working machinery—both new and second-hand—may be found at the George Place Machinery Agency, 121 Chambers street, New York.

Messrs. Clark & Co., of 162 and 164 West 27th street, this city, have lately fitted six of their largest patent noiseless self-coiling steel shutters they have yet made, to the windows and doors of Theo. B. Starr's diamond establishment, fronting 206 Fifth avenue and 1126 Broadway. The openings vary from 7 to 8 feet 6 inches in width and are 20 feet high.

We call special attention to the card of Messrs. Tallman & McFadden, of Philadelphia, in our advertising columns, and would advise those wishing machine tools of any description to send for the Metal Worker's and Wood Worker's Catalogues of this firm. We have the same before us, and find them replete with every kind of tool employed in the industrial arts. The catalogues are profusely illustrated, and a credit to this enterprising firm.

Experiments have recently been made at Colt's factory at Hartford, on a new substitute for steam boilers, particularly adapted for use in pleasure yachts and small craft generally. It is an automatic self-feeding apparatus, furnishing great propelling force in little space. The steam generating apparatus weighs only 350 pounds and the engine only 400 pounds. The water supply is only 4 or 5 gallons and the water runs back to the fountain and is used over again.

Lyons' portable balanced derrick is indispensable in localities where a constant shifting of the machine is necessary in order to reach the material to be lifted; it is arranged so that it can be run back and forth, and turned on its center at any point, and its adaptability is therefore very great. It must prove especially useful in quarries, on railroads, in foundries, and in the erection of bridges and buildings. The manufacturer of this excellent derrick is Frank Lyons, of 14 Center street, New York.

It is evident that no building can offer security against fire unless entirely protected by fire-proof material throughout, and it is therefore as essential that the windows and doors should be protected by a fire-resisting covering as for the main structure itself to be fire-proof, so as to be safe from conflagration at times when the building is deserted. An establishment that has earned a great reputation for its productions in iron for the purposes to which we have just referred, is the Eureka Iron Roofing Co., of Cincinnati, O., for which Mr. W. T. Wells, of 78 Beekman street, this city, is Eastern agent. This company not only manufacture fine sheet-iron doors and shutters, but roofings and sidings also.

STOCK SPECULATION.

10 dollars to 100 dollars invested in Wall street stocks, makes fortunes every month. Pamphlets containing "Two Unerring Rules for Success," sent free. Many of our customers in all parts of the country are realizing large amounts every thirty days. Send for pamphlet explaining everything. Address Simpson & Co., 49 Exchange Place, New York.

A Suburban Villa.

We publish this month plans and perspective of an attractive suburban villa, in the Queen Anne style, designed by Mr. W. H. Beers, architect, of 150 Broadway, New York. It contains nine rooms, exclusive of butler's pantry, bath-room and halls, as follows: The first floor contains a parlor, 16 × 20 feet; library, 16 × 18 feet; kitchen, 13 feet 6 inches by 17 feet; dining-room, 16 × 18 feet; and hallway, 16 × 17 feet. On the second floor there are four bedrooms of the following respective dimensions: 14 × 16 feet; 16 × 17 feet; 13 feet 6 inches by 7 feet; and 15 × 17 feet. There is also a hallway here to correspond to the one on the first floor.

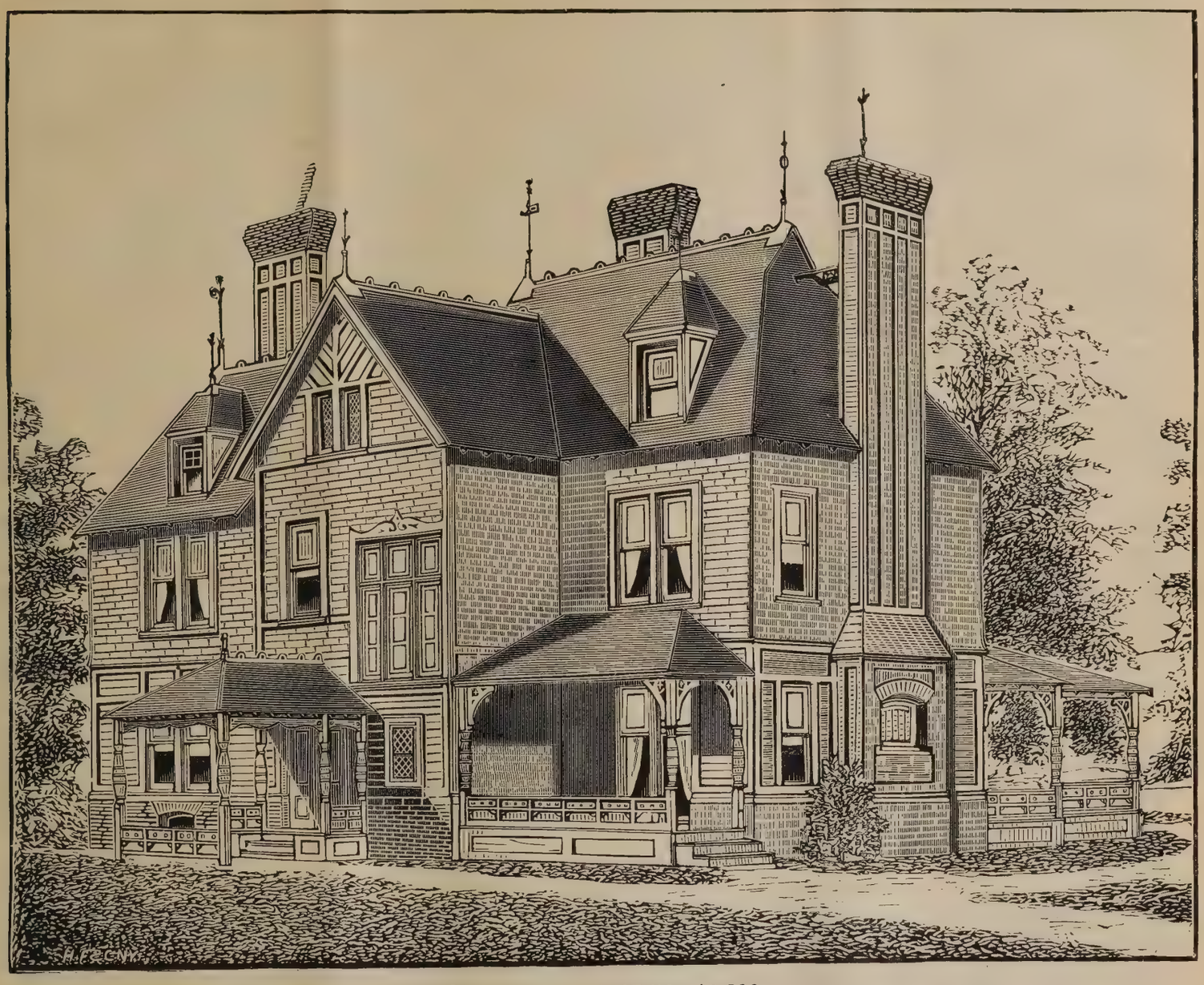
The main staircase is placed in an alcove, with a large stained glass window on the landing, which serves to light both halls, and makes a very attractive feature. There is also a back hall and staircase for the servants; this hall shuts off the kitchen from the main hall and also from the dining-room by two doors through the butler's pantry, thereby avoiding any possibility of odors escaping from the kitchen. Across the rear of the house extends a piazza, which breaks around the projection made by the dining-room; there is also a small piazza in front, which could be continued across the front with very good effect, if the requirements of the situation were such that a piazza in the rear would not be desirable.

The four chambers on the second story have each two closets. There is also a bath-room, and one small chamber connecting with large chamber, which could be used as a sewing room or child's room.

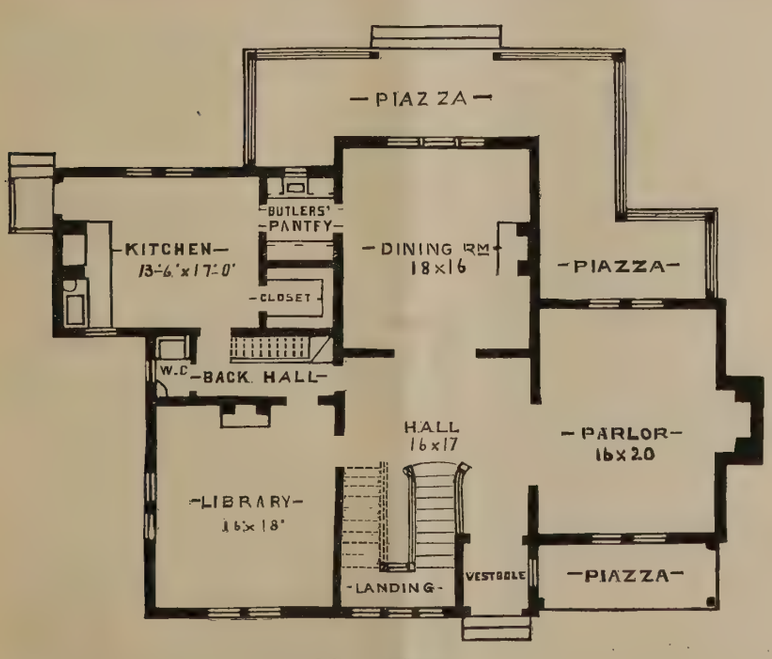
In the roof there are two fine servants' rooms, storeroom and attic.

The water-table is carried up and forms the window sills of the first story windows in brick, and above that to the line of the second story floor beams the frame is covered with clapboards, and from that point to the eaves shingled and painted, with bands of octagonal cut shingles. The roof is also covered with shingles, painted red.

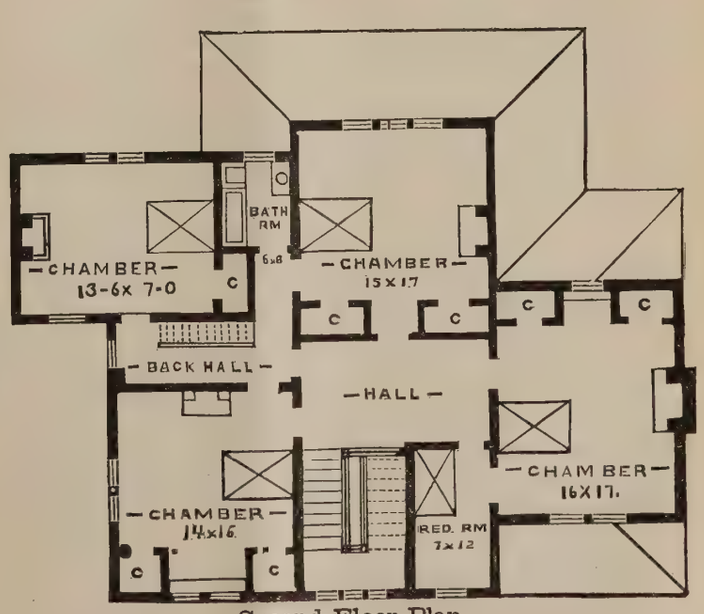
This house, built in the best manner, would cost, exclusive of plumbing, $3,500. Any further information in regard to it can be had, either in person or by letter, at the office of the architect, as above.



DESIGN FOR A SUBURBAN VILLA, COSTING $3,500.—W. H. BEERS, Architect.



First Floor Plan.



Second Floor Plan.

Scale of Villa, 8 feet to the inch; Scale of Floor Plans, 16 feet to the inch.

The Georgia Gold Mines.

Harper's Monthly for September contains an interesting article on the gold production of Georgia, written by Ernest Ingersoll, from which we extract the most interesting portions:

"The Georgia gold belt consists of a strip of land running irregularly northeast and southwest across the northern end of the state. It averages about 10 miles in width, and has been traced 200 miles in length, parallel with the Blue Ridge. Cherokee Indians were the occupants of the territory when white settlement first began, and they were accustomed to seek the gold for ornamental purposes, and to dispose of it in barter. Evidences of their mining still remain. The methods adopted by the first white settlers were very rude, consisting merely of washing out the gravel of the beds of the streams by running it through sluice boxes and splint baskets into a 'gum rocker,' which was nothing but a split and hollowed out log twelve or more feet in length. While the water from the sluice box passed through this trough from end to end, the rocker was kept in constant motion, and the heavy gold, permitted to sink to the bottom through the constantly agitated silt, was caught by transverse cleats, with or without the aid of mercury. The first piece of gold ever taken in the United States belonged to this deposit, and was picked up in 1799 by Conrad Reed, a boy. It was as large as a smoothing-iron, but was sold to a silversmith for $3.50. Afterward much larger lumps were found —one weighing 28 pounds. This excited so much attention that exploration was begun, and the gold traced southward, until the borders of the Cherokee territory in northern Georgia were reached, and prospectors began to encroach upon the reservation. Protests from the Indians followed, and Georgia sent a large police force to keep back the invaders, but it was of little avail. The rush to the mines was much like the stampede to the Pacific coast in 1849, and reckless, dissipated men from all quarters of the country flocked in, prowled about the woods, set up log huts and shanty groceries on all the streams, and paid no respect to the rights of the Indian, or any one else. Even United States troops were powerless to keep the lawless hordes west of the Chestatee; and here, as elsewhere, the discovery of gold was the end of Indian possession and aboriginal simplicity and charm.

"Finding that no protection of the Indians by police measures was feasible, the State in 1830 adopted the Indians, territory and all, and constituted the region a county called Cherokee, out of which several small counties have since been made. Then the mineral lands were divided up into forty-acre lots, and put up at lottery by the State. One of these lots, on the Yahoola River—No. 1052—now a part of the Hand Company's property, had already become celebrated. It was within the reservation, but men used to creep across to it at night and carry home a meal-bag full of dirt, out of which they would pan from $20 to $40 next day. As soon as it was ascertained that an old farmer down in the central part of the State had drawn this prize, shrewd speculators set off post-haste to buy it from him.

"It soon came to be found here, as elsewhere, that gold was not to be picked up in 28-pound lumps every day, nor did every bushel of soil pan out a double eagle. The worthless, lazy, and dissolute majority of the early horde of invaders gradually drifted away, while only the small minority of new-comers, whose accession was of real value to the community, remained, The population, like the dirt, was slowly panned out, and the current of events carried the dross away. At present the mines are largely owned by corporations, or by private capitalists who are not residents of the district. It was found that as the gold occurred neither in extensive placers, like those of California, nor in indestructible quartz lodes, the methods of mining in vogue elsewhere would not answer here. The inventive genius and practical knowledge of those interested were therefore set to work to devise the best means of meeting the case, and it was speedily found that the best agent was water. So far as this mere fact is concerned, it could hardly be called a discovery, but the utilization of the idea, and the practical methods by which the enormous power of this natural agent has been put under the miner's control, are the work of Colonel Hand, to whom belongs the credit of the splendid development of this industry during late years, and the glowing prospects it now holds out.

"One of the greatest enterprises executed according to his plan, was 7 or 8 miles up the Yahoola River, where a dam was built where the stream rushes through a picturesque gorge, whence a ditch 6 feet wide and 6 feet deep was led along the hill-side, in and out of all the curves, sometimes through a short tunnel, then across an aqueduct, here and there, wherever its level led it, at a grade of 4½ feet to the mile, 20 miles down to the mines. This is the main big ditch; it has two or three large branches, and there are other lesser ditches throughout the region, supplying separate isolated mines, but none have so elevated a head or carry so great a volume of water as this, and it is the best type of them all. When first constructed, there were many flumes and trestles along its line. Some of the trestles were over 100 feet high, of great length, and a constant expense to keep in repair. At one point an attempt was made to cross the bed of the Yahoola where the hight of the trestle would have been 250 feet, and its length nearly half a mile; by a lavish expenditure of money the structure was carried to a hight of 150 feet, when it was found that the lower timbers had already rotted out. The scheme was therefore abandoned and the vast erection demolished, entailing a loss of almost $200,000. Engineers say that, with all the appliances and force which could be brought to bear there, it would be impossible to build a high trestle as fast as it would decay at the foundations.

In place of this, iron pipes were substituted, and an inverted siphon made. The descent from the top of the hill is at an angle of 45°, and is 215 feet in length; the pipes then cross the bed of the stream upon wooden supports a distance of 167 feet, and ascend the opposite bank 209 feet. The pipes are made of heavy boiler plating, and inside are 36 inches in diameter. The water rushes through them with a pressure of nearly 100 pounds to the square inch at the bottom, and that is sufficient to overcome the friction and lift the column of water on the other side to within 6 feet (and perhaps nearer) of the level of the starting-point. It was found not long ago that some men had been accustomed for a long time to shoot through these pipes sticks of cord-wood, cutting them on the mountain opposite their homes. Finally they got to running whole logs through; but one was too long and got stuck, which led to the detection of this labor-saving fraud. At other points subterranean wooden tubes of equal caliber, similarly arranged, conduct the stream across the valleys. One of these tubes is 1,500 feet in length.

Having got this tremendous head of water at their disposal by the completion of the ditch, stamp mills were built far below in the valleys at points suitable to the best diggings, and they were ready to begin operations upon the new system. The cutting having been opened at the brow of the hill, a reservoir is constructed, in which the water from the ditch is allowed to accumulate to the amount of thousands of gallons, whence a side ditch, controlled by flood gates, leads to the upper edge of the cutting. From the mine downward a channel is arranged, as precipitous as possible, leading directly to the stamp mill, where a room is open to its entrance. If now a torrent should suddenly be poured into the cutting, away up there on the edge of the mountain, which seems almost to overhang you, it is evident that all the loose material would be swept out and sent headlong downward to the bottom of the hill. What a natural freshet would accomplish by accident is precisely what the miners do by artifice. They dig away all day at the loose soil and easily disintegrated rock, break up the larger fragments into small pieces, and strew everything, good, bad and indifferent, in a careless pile on the floor of the cut; then at sundown they gather up their tools, climb out of the diggings, and open the gates of the reservoir. A torrent sweeps through the mine, cleans out every loose rock and fragment of dust, and hurls it down into the mill, where a rack catches all the coarse material and lets the water drain through into the much tortured Yahoola. The whole product of the day's excavation has been deposited on the floor of the mill, half a mile away, ready to be shovelled under the stamps, which chew on it all night, and it has not cost a penny for transportation."

Another Large Suspension Bridge.—The small suspension bridge over Niagara River, seven miles below the falls, between Lewiston and Queenstown, is to be abolished. The ruins of the old bridge, which have disgraced this spot for some years, will be removed and a million-dollar suspension bridge, for railroad and highway travel, constructed instead. The old structure was built just thirty years ago, but lasted scarcely twenty years, and as the old company appeared to be unable to repair it, a new company bought up the stock of the old company. The river is 600 feet wide at that place, while communication is now kept up by a ferry. The new bridge will be one of the finest structures of the kind in existence, and a great accommodation to trade and travel.

New Publications.

A Practical Treatise on the Combustion of Coal. By William M. Barr. Indianapolis, Ind.: Yohn Brothers.

This is an excellent book, which within a moderate compass presents the theory of the combustion of coal, with the view to instruct the great number of men who need this knowledge, but thus far have been debarred from it by reason of the highly scientific style in which books on this subject are generally written. The author does not claim to present new views, and we rejoice at this disclaimer, as the accepted theory is now all that can be desired; but what he does claim, is the presentation of the subject in a correct and intelligible manner. He does not confine himself to coal alone, but also gives descriptions of various mechanical devices for the economic generation of heat, whether by solid, liquid or gaseous fuel. We hope that the author, who has published this book at his own expense, will be recompensed by a large sale. The paper and print are excellent, and as great a credit to the publishers as the contents are to the author.

Knickerbocker Novels. "A Man's a Man for 'a that." New York: G. P. Putnam's Sons.

This book is the result of travel upon a cultivated mind. The author, who keeps *incognito*, states in the preface, which he calls his "Apologia," that when once he ventured some severe strictures upon a novel in presence of the author, he was answered: "You know nothing of the difficulties you mock at. The wholesomest alkali for critical dyspepsia is an honest attempt at production. Try it." The author tried, and we have the book before us. It was not published until two years after it was written, so that it had time to cool; but the author says that it was then issued unchanged, without further revision or excuse. As a whole, the book is very creditable, being highly entertaining, and at the same time instructive, a praise which we are sorry to say can be given to very few similar publications of the present day.

The Silk Goods of America. By William C. Wyckoff. New York: D. Van Nostrand.

This work, published under the auspices of the Silk Association of America, contains a brief account of the recent improvements and advances in silk manufacture in the United States. It treats, in successive chapters, on raw silk, sewings and twist, weaving, spun silk, dress goods, handkerchiefs, ribbons, trimmings, passementerie, silk laces, and dyeing; while it closes with the seventh annual report of the Silk Association, containing some very valuable statistics with reference to this important and promising industry.

The general appearance of the volume is a credit to all concerned in its publication. It is a model of good language and excellent typography.

PAMPHLETS RECEIVED.

Notes on the Result of an Experiment with the Wheeler Process of Combining Iron and Steel in the Head of a Nail. By W. E. C. Coxe, Reading, Pa. Read at the Chattanooga (Tenn.) meeting of the American Institute of Mining Engineers.

Iron-Clad Steel; or, How to Make Steel for Structural Uses, including steel plates, free from liability to fracture under concussion or vibratory strains. Philadelphia Combination Trust Company.

Papers read before the eleventh and twelfth annual conventions of the American Institute of Architects, held in Boston and New York, October 17th, 1877, and November 13th and 14th, 1878. Boston: A. Williams & Co.

Notes and Queries.

This department is intended to furnish, for the benefit of all our readers, information on any subject of scientific or practical knowledge falling within the field of The Manufacturer and Builder. *All persons possessing additional or more correct information than that which we give relating to the questions, are cordially invited to communicate it to us for publication. We also request that all questions or answers be written on separate pieces of paper, and addressed to the Editor.*

QUESTIONS.

(2478) Removing Freckles.—I asked the *Scientific American* for a recipe for removing freckles instantaneously, or by repeated applications, and the answer was: "A solution of corrosive sublimate, either pure or mixed with cyanid of mercury, is commonly employed for the removal of freckles." I am suspicious that this is a very dangerous remedy. Am I right?—* * *

(2479) Mortar on Brick Walls.—Why is it that mortar or plaster is not put directly on the bricks on the inside walls of buildings, instead of on the laths?—A Subscriber, New York City.

(2480) Expansion of Metals by Heat.—What simple metal, and also what alloy expands most under a given increase of temperature?—C. C. T., Elizabeth, N. J.

(2481) Extremely Expansive Alloy.—In what direction, and how shall I conduct experiments, towards discovering an alloy that will expand more than any known? By combining similar metals, or dissimilar?—C. C. T., Elizabeth, N. J.

(2482) Expansion of Brass vs. Type Metal.—I made a thermostat of brass and type metal. On being heated, the bar bends toward the brass, which would indicate that type metal expands more than brass. This the *Scientific American* says is a fact; but is it not open to doubt?—C. C. T., Elizabeth, N. J.

(2483) Purifying Mercury.—What is the simplest way to purify mercury, without distilling it?—G. G., Bidwell's Bar, Cal.

(2484) Divining Rod for Gold and Silver.—Will you be kind enough to inform me where I can buy in New York city an instrument that will indicate the presence of gold or silver beneath the surface, without digging for it. I am pretty sure that such an instrument is made and sold in your city. I want one for gold and silver only.—Miner, Evansville, Ind.

(2485) Bad Whiskey.—There is a great deal of talk about bad whiskey, which I do not believe. Is the cheap kind of whiskey really unwholesome? If so, what is there in it that makes it so?—S. J., Haynesville, Ky.

(2486) Reliable Connections for Hide and Leather.—Can you inform me whether there is any substance known that will adhere or stick firmly together any fatty matters, such as rawhide or badly tanned leather, and one that will last?—P. L., Montreal, Canada.

(2487) Cord Machine.—I enclose a sample of cord used for ladies' dresses? Will you please give me an idea of the kind of machine it is made on.—J. W. K., New Haven, Conn.

(2488) Liquid Shoe Polish.—Please give a recipe for a liquid polish for boots and shoes—water-proof and otherwise.—O. C. C., Worcester, Mass.

(2489) A Question in Construction.—In building a frame church with an open roof—that is, with the principal rafters and perlins all dressed and sheathed with dressed lumber—ought not the principal rafters at the ends of the building to show inside of the gable ends the same as the other principals? or is it proper for the studding of the gable to be cut under the principal rafter and the same to be ceiled over, or plastered same as the walls?—J. L., Rockdale, Tex.

(2490) Finding the Bevels for Rafters.—How can I find the bevels by which to cut the short rafters that fasten to the ridge or hip rafters of a hip roof, for the different angles of pitch of roof?—C. E. C., West Meriden, Conn.

(2491) Cause of Shooting Stars.—What is the latest explanation of the cause of shooting stars?—D. J. N., Henryville, Ill.

(2492) Polishing Wood Carvings.—What is the best way to polish carvings in wood?—G. S., Patoka, Ill.

(2493) Testing Oil for Acids.—How can I test the purity of oils and grease, to ascertain whether they have been cleansed from the acids used in purifying them, or whether they have become rancid and acid from age?—D. G., Croydon, N. H.

(2494) Speed of Parts of a Revolving Wheel.—Which part of a wheel turns the fastest? When a wheel revolves does any one part travel through more space than another? If so, why?—W. F., Jamestown, Tenn.

(2495) New Railroads.—How is it in regard to railroad building now? Are there any statistics giving their increase?—F. T., Morgan, Vt.

(2496) Place of the Battery in a Telegraph Line.—Will a battery work a 25-mile telegraph line, placed half way—say 12 miles from each end of the line? If it will, is there any objection or undesirability to such placing? If it will not, why not?—E. B. W., Mont Alto, Pa.

(2497) Preventing Iron from Bending and Twisting.—There is a French patent that claims a method to prevent iron hooks from bending and iron rods from twisting easily. Can you tell me of what the method consists?—S. A., Napa City, Cal.

(2498) Phosphorescent Meat and Fish.—I am the proprietor of a meat market, and a few nights ago I noticed that a piece of beef gave off a phosphorescent light, and even the blood that had dropped from it on the floor. Can you explain this phenomenon?—W. E. M., New York City.

(2499) Difference Between Liquid Shoe Polish and Boot-Black Paste.—Please explain the difference between liquid shoe polish and the old-fashioned paste.—G. R., Norwood, Ill.

(2500) Artificial Strawberry and Raspberry Flavors.—How can I make the strawberry and raspberry flavors? Does not modern chemistry teach this? Are these imitations wholesome?—D. L., Oakville, Conn.

(2501) Fire-Proof Preparations.—Can you recommend some solutions to render combustible substances, such as paper or canvas, fire-proof?—J. A., Perry's Mills, N. Y.

(2502) Heat Subtracted by Freezing.—In the freezing of 25 pounds of water at 60° Fah., how much heat must be given off?—E. A. E., Brooklyn, N. Y.

(2503) Gynecology.—What is gynecology? I see that a society has been formed under that name. What is its object?—R. W., New York City.

(2504) Refining Bismuth.—What is the best way to purify bismuth?—W. G., Dedham, Mass.

REPLIES.

(2478) Removing Freckles.—You are perfectly right. Both the mercurial compounds named are exceedingly poisonous, not only when entering the system in very small doses, but are apt to be absorbed if used as a wash, and almost certain to produce no little trouble when the application is repeated. The smallest quantities may in some individuals produce the most serious symptoms of constitutional poisoning. We consider it a very dangerous thing for papers to give remedies like this to the public. Most persons have no idea of the imminent danger they are running when using such washes.

(2479) Mortar on Brick Walls.—For inside or partition walls between houses in cities, the plastering is most always put directly upon the bricks; but for outside walls exposed to the weather, it is better not to do this, but to leave a space between the brick wall and the plaster, and as this is easiest accomplished by laths, it has become customary. There are two reasons for this: 1st. Protection against heat and cold is better secured by a double wall with an air space between, and a wall interiorly plastered against lath is equivalent to a double wall. 2d. Protection against moisture. Brick walls are often liable to be penetrated by moisture, especially when the bricks are soft, or the mortar fresh or inferior; also when exposed to the east, when the rain propelled by the wind is driven against them. In such a case there is a great difference between a wall plastered against the bricks, which will soon become wet inside, and a wall provided with lath and plaster, which will remain dry on the inside, as the moisture will not reach the interior, but remain in the space between the wall and the lath and plaster.

(2480) Expansion of Metals by Heat.—Of all metals zinc, and next to this lead, expands most by heat, and the alloys expand more in proportion to the amount of zinc or lead they contain. Thus, the expansion of copper is increased by alloying it by the addition of zinc and changing it into brass.

(2481) Extremely Expansive Alloy.—The best answer to this question may be obtained from the coefficients of expansion, determined by experiment. They are as follows: A standard measure, divided into 10,000 parts, will show that bars of the following metals will, when heated from the freezing to the boiling point of water, that is, for 180° Fah., approximately expand as follows: Zinc, 29 parts; lead, 28; tin, 22; silver, 20; copper, 17; gold, 15; forged iron and hard steel, 12; cast-iron and soft steel, 11; antimony, 10; hard glass, 9; platinum and soft glass, 8. In regard to alloys—soft solder, consisting of two parts lead and one of tin, is represented by 25; hard solder, consisting of one of zinc and two of copper, by 20; ordinary brass and bronze vary, in proportion to the ingredients, from 19 to 18. It thus appears that zinc alone gives the maximum expansion, and among alloys that of zinc and lead. Practical experiments conducted by Calvert and Lowe in England have proved that the expansion does not strictly follow the law of the proportions of the components, but that the expansion is always less than that deduced by calculation from the components. This was especially found to be the case with tin, which, notwithstanding it expands more than copper, causes a diminution of the expansion of copper when alloyed with it in small quantities. The same experimenters found that the rate of expansion was reduced when the metals were not pure, but such as found in the commercial state. Matthiesen found that the expansion of alloys is approximately proportional to the ratio of the relative volumes of their constituents, and not of their weights. It appears from all the foregoing that in order to obtain extreme expansion, pure zinc must be used, and that no alloy can reach its coefficient. Some other non-metallic substances may give a greater expansion than zinc; such a one is hard rubber, of which the expansion, expressed according to the above table, would be from 40 to 50, while the expansion of sulphur is expressed by 60; the latter is perhaps the most expansive solid thus far experimented upon.

(2482) Expansion of Brass vs. Type Metal.—Brass is an alloy in which the most expansive metal is zinc, while type metal is an alloy in which the most expansive metal is lead; as these alloys are both very variable, their comparative expansion will depend on the relative preponderance of zinc or lead. A quality of brass containing much zinc will expand more than hard type metal containing little lead, while, inversely, a soft type metal containing much lead, such as used for printer's slugs, will expand more than a brass alloy containing little zinc, and in which copper prevails.

(2483) Purifying Mercury.—Distillation will remove all non-soluble metals, but the volatile ones, such as zinc, will go over with the mercurial vapors, and will not be removed in this way. As mercury nowadays is very apt to be amalgamated with zinc, from the extensive custom of amalgamating zinc plates in galvanic batteries, another method is employed, and largely used by barometer and thermometer makers, as it removes at the same time other common impurities, such as tin, lead, antimony, copper, etc. It consists in shaking up the mercury with hydrochloric acid; this dissolves a little of the mercury at the same time, but the loss experienced in this way is fully compensated for by the gain in time and trouble over distillation, even when the mercury is free of zinc. After agitation, the acid is poured off and water substituted, and shaken up to remove all acid; this washing is repeated, the water poured off, and in order to dry the mercury, pulverized plaster of Paris is put upon it, which will absorb all the water and leave the pure mercury under the small solidified pieces of the plaster, which are then easily removed. Another similar process is to use, instead of hydrochloric acid, a solution of 1 part of bichromate of potash in 200 parts of water, with the addition of a few drops of sulphuric acid; after shaking up, the liquid will be green; it is then poured off and washed with water, so as to remove a green powder formed at the same time, which is a mixture of the chromates of lead, tin, zinc, copper, etc. The process is repeated as long as the liquid becomes green; finally the mercury is well agitated with pure water until bright, and then dried with plaster of Paris, as before described.

(2484) Divining Rod for Gold and Silver.—You have undoubtedly heard the story of divining rods, by which, from time immemorial, impostors have deluded the credulous. There is no instrument made in New York, nor anywhere else in the world, that will honestly indicate the presence of gold or silver beneath the surface without digging for it; but there are false pretenders almost everywhere who claim that in their hands a divining rod will indicate a hidden treasure; the spot where there is water if you want to dig a well; or the place where underground electric currents run, and where lightning rods are necessary. The latter is the latest humbug in this line. The instrument, or divining rod, with which these objects are accomplished, is, in every case, the same thing—a bifurcated twig of witch hazel, the two thin ends of which are firmly grasped in both hands, and, walking over the ground, the thicker end, as is pretended, will bend downward when the right spot is reached where it is desired to find either gold, silver, water, electricity, or anything for which you choose to pay the divining rod man. The business is safest for finding electricity, as a lightning rod is always useful, no matter where you put it—at least no one can prove that it is not. Next to this is water, as you can find it almost anywhere if you only dig deep enough. As for finding gold and silver, it is very uncertain, except in such regions as those around Golden City, Colo., where the ground is everywhere charged with gold. In mining regions these instruments for finding gold and silver without digging, have long since lost their credit. If you want an instrument that will show the nature of the ground at great depths, and thus indicate the chances of finding gold, and bringing up specimens of the same, you can find in New York what you want; it is the diamond rock drill. It consists of a hollow tube, furnished with cutting diamonds around its lower edge; it cuts out a circle in the rock, the central piece entering the tube, which may be drawn up with it. This instrument is largely used in mining regions, and holes have been bored with it to the depth of several hundred feet, and the central piece coming up, showed the nature of the ground beyond a doubt. It has brought up gold quartz and silver ore, and has shown whether there were salt beds or coal deposits below. It is therefore very evident that there is no instrument, such as you want, for gold and silver only. There is one, however, for iron, but it is for iron only. As the richest iron ores are always magnetic, they affect a compass needle, and such a needle is made for this special purpose; it is a dipping needle, carefully balanced, and in a region rich in iron ore, the amount of the dip of the needle will vary, and thus indicate where the ore is.

(2485) Bad Whiskey.—All alcoholic liquors not properly rectified contain propylic alcohol, aldehyde, and acetic ether. Propylic alcohol was first isolated by Chancel, in 1853, in the fusil oil of the residue left in the distillation of brandy from wine. It is highly poisonous. Aldehyde is the result of the careless distillation of liquor, and a result of the decomposition of alcohol; it is a suffocating anæsthetic, and an injurious one also; the preparation and manipulation of the pure article is dangerous to chemists. Acetic ether is also an injurious ingredient, resulting from an alteration of the alcohol by the influence of acetic acid, formed by a careless fermentation at too high a temperature. All cheap whiskeys, brandies, and other liquors contain these substances, which give them a bad and sharp taste, and entail injurious consequences when used. Pure alcoholic liquors of a smooth taste are the least injurious, but it is best to abstain from distilled liquors altogether; if you must have some stimulating drink, confine yourself to malted beverages, such as good beer; or fermented ones, such as pure wine made from grapes. The grape appears to be intended by nature to make wine from; no other fruits make such good wines, as they are not adapted to it.

(2486) Reliable Connections for Hide and Leather.—You err in the expression "fatty matters, such as rawhide or badly tanned leather." Neither rawhide nor badly tanned leather can be called fatty matters; they may be entirely free from fat, and in that case you can use good glue, drying it and at the same time keeping the surfaces to be united under sufficient pressure. Really fatty matters cannot possibly be united with glue. If the rawhide to be united is greasy, it may be well to remove the grease first from the surface by rubbing it well with some solvent for fat, such as ether or benzin, to remove the fat; then rub with alkali or soap, and after it is dry apply the glue. If the joint is very small it is difficult to make it stick, therefore you must give sufficient surface. If the joint is to be bent, and the hard, dried glue would crack, you can prevent this by adding a little glycerin, say one per cent. If the joint has to suffer much wear and tear, as is the case with belting, there is no known substance that will make it stick in a lasting manner, hence belting is always riveted together with copper rivets, or laced. These are the only ways of obtaining a reliable and lasting connection, whether the leather is badly or perfectly tanned.

(2487) Cord Machine.—We fail to see any difference between the twist of the cord sent and that of any kind of rope, except in size. The cord enclosed was evidently made on a machine perfectly identical with those to be found in any rope-walk, only on a much smaller scale.

(2488) Liquid Shoe Polish.—Take 2 ounces of gum senegal, 2 ounces of sugar, and dissolve in 1½ pints of any kind of wine or beer; when dissolved, add 1 ounce of iron sulphate and ½ an ounce of pulverized gallnuts, heat without boiling, remove from the fire, and filter; when cold, add 4 ounces of alcohol, then bottle. For additional details we refer you to our answers to Queries 1044 and 2141 in our numbers for August, 1874, and July, 1878. In regard to water-proof shoe polish, there are two kinds; one made of a solution of shellac in alcohol, to which some camphor and lampblack are added, (8 parts of shellac, 1 of lampblack, 1 of camphor, and 30 of alcohol). The other kind is made of a solution of pure rubber in any of its solvents, such as benzole, chloroform, bisulphid of carbon, etc.—in fact, the thick rubber paste or varnish, which can be obtained in tin boxes in the rubber stores, when diluted with one of these solvents, makes a good water-proof varnish for boots.

(2489) A Question in Construction.—By all means let the principal rafters be shown.

(2490) Finding the Bevels for Rafters.—The simplest way is to take your square, and laying it upon the timber so as to give the scale of one inch per foot, let the length of the main rafter represent one bevel, and half the span the other bevel. This is perfectly accurate and reliable.

(2491) Cause of Shooting Stars.—The explanation which astronomers have given to the curious appearances ordinarily called "shooting stars," is about the same as it has been since Kepler broached the theory that there are more meteoric masses in space than there are fishes in the sea. It has since that time been supposed that some of these objects have occasionally reached the earth, and on entering our atmosphere have taken fire and been consumed, either entirely, or what was left fallen on the ground and formed the well-known meteoric stones or metallic masses. The only modification of this theory, is that fallen meteorites lastly referred to are of a different class from shooting stars, which are entirely burned up, and may be parts of comets, or of their tails, and that when flying about in space they are about the size of a pea, therefore utterly invisible in space, and only become visible on taking fire in our atmosphere, shining there for one or two seconds with the light of their own combustion. It is estimated that not less than 800,000,000 of these shooting stars rain upon our earth every twenty-four hours, most all of which burn up; only those falling at night can be observed, and there is always a large number falling somewhere; we can scarcely look into a clear sky during the night for five minutes without seeing some of them. Some nights they appear by thousands, and it is supposed that our earth is then passing through a belt of these bodies which is moving around the sun, like the planets or comets. Some think that these belts are left behind by comet tails sweeping through space, and may form irregular rings, which, when encountered by the earth at fixed periods, which are August 11th and November 14th in the morning, and November 24th and 27th in the evening, produce star showers. This idea is very probable, as the last two periods correspond with the track of Biela's comet, through which our earth passes, and which comet itself our earth perhaps divided into two parts in 1846. Since that time this comet has shown two heads, and is now gradually becoming extinguished, defaced, or changed into a tail; this tail, in diffusing more and more, forms another ring. Some of these rings are very eccentric. This comet's nearest place to the sun being in the orbit of the earth, and its greatest distance stretching to the orbit of Neptune, a circumference of 11,000,000,000 miles; it appears to have a thickness of 16,000,000 miles, because it takes the earth 10 days to pass through it, which it does in August.

(2492) Polishing Wood Carvings.—We copy from the *Furniture Trade Journal*, which ought to be an authority in such matters, the following instructions: "Take a piece of wadding, soft and pliable, and drop on it a few drops of white or transparent polish, according to the color of the wood; wrap the wetted wadding up in a piece of old linen, forming it into a pad, hold the pad by the surplus linen, and touch the pad with one or two drops of linseed oil; pass the pad gently over the parts to be polished, working it around in small circles, occasionally re-wetting the wadding with the polish and the pad with a drop or more of oil. The object of the oil is merely to cause the pad to run over the wood easily without sticking, therefore as little as possible should be used, as it has a tendency to deaden the polish to a certain extent. Where a carving is to be polished after having been varnished, the same process is necessary, but it can only be applied to the plainer portions of the work. Plain surfaces must be made perfectly smooth with fine sandpaper before polishing, as every scratch or mark will show twice as badly after the operation. When the polish is first rubbed on the wood, it is called 'bodying in, as it sinks into the wood and does not give much glaze. It must, when dry, have another body rubbed on, and a third generally finishes it; but if not, the operation must be repeated. Just before the task is completed, greasy smears will show themselves; these will disappear by continuing the gentle rubbing without oiling the pad."

(2493) Testing Oil for Acids.—One test is made with blue litmus paper; if dipped in the oil or melted fat, it will become red if an acid is present. Another test is with cuprous oxid or coppersmith's scales. Place them into the test tube, and then the grease or oil; if the color of the latter does not change, no acid is present; if it becomes greenish, acid is present. It must be observed, however, that the fat used for manufacturing stearin candles is not neutral, but, being deprived of its glycerin has obtained an acid reaction—in fact, it has become stearic acid, and this of course being an acid, will behave as such, and the acid reaction is here no test of purity.

(2494) Speed of Parts of a Revolving Wheel.—We suppose you mean the wheel of a wagon. In a stationary wheel, of course every part of the outside rim revolves with the same velocity, and faster than any part between it and the center, as it moves through the largest circle in the same length of time. But with a wagon wheel rolling upon the ground it is different. In relation to the wagon, it acts as a stationary wheel and turns around the hub; but in regard to the ground, the part touching the ground stands still for the time being, while the center of the wheel has the velocity of the wagon, and the top of the wheel moves exactly twice as fast as the wagon, the parts in front of the hub are obliquely descending forward and the parts behind the hub are obliquely ascending forward also. The best way to make this clear is to draw a cycloid, which is the curve described by one of the nails in the rim of a wheel, and which you may trace on paper by rolling a round disk along a rule, and following with a lead pencil one point in its circumference and tracing it upon paper.

(2495) New Railroads.—There are statistics, but they are not always easily accessible. We do not know how it is at the present time, but up to August 1st there had been constructed this year 1,122 miles of new railroad, an increase of 222 miles over the same period last year, and the largest recorded construction for the same time of any year since 1873. New companies are constantly organizing and building, and the old lines are constructing feeders, branches and connections, and generally strengthening their systems. It is in nearly every case undertaken in response to a legitimate demand for increased transportation facilities, and is therefore a healthy movement, assuring actual and permanent advantage to the public and the country, and profitable returns to the projectors. Among other items, it is reported that the work on the Louisiana Western railroad is progressing steadily all along the line, notwithstanding the yellow fever scare. The work has been retarded somewhat by the non-arrival of iron, a large quantity of which is shipped on the vessel with the bridge. Bridging the Sabine river will be about the last job on the whole line, and if nothing occurs to stop the work, that will be finished by the first of December, and the connection between Texas and New Orleans will be complete. Articles of incorporation have also been filed for two new railroad lines, one from Portage City, Wis., to Freeport, Ill., and the other from Medford, Wis., to the Mississippi river. The two lines in question have long been contemplated in connection with the Wisconsin Central management, and will be built at an early day. Lastly, the large increase of the wheat areas and the fine crops along the Northern Pacific road, will cause the rolling stock of that road to be largely increased. One hundred box cars and four powerful freight engines have been purchased. The company is rapidly grading a branch of its road from Casselton northward, which is to be completed this fall for a distance of 30 miles; the iron for 25 miles has been received at Duluth, and will be laid in time to ship the crops of the large northern farms.

(2496) Place of the Battery in a Telegraph Line.—In such a short line you may place the battery anywhere, even at the other end of the line, providing your conducting wire is of sufficient size. When the wire is thin, or when the line is very long, thus offering much resistance, it is customary to place a battery at each end of the line. If you choose, you may do this, and even place a third battery half way also.

(2497) Preventing Iron from Bending and Twisting.—The method you refer to is probably that of A. Seguin in Paris. It consists in heating the iron to a cherry-red heat, and then plunging it into a bath consisting of hot diluted sulphuric or hydrochloric acid, or into a mixture of 1 part of turpentine with 5 or 6 parts of water. In case turpentine is used, the mixture must be constantly stirred, to prevent the turpentine from floating and igniting when the red-hot metal is immersed. The metal is kept in the liquid until it has obtained its temperature, when it is thrown into cold water.

(2498) Phosphorescent Meat and Fish.—There are three different causes for phosphorescent phenomena. The most common is the formation of microscopic animalculæ, which are evolved from material in the first stage of decay, and live upon the decaying ingredients. They are provisions of nature to hasten decay; they are sometimes so abundant in sea-water that they form a surface of many miles in extent, luminous with a phosphorescent glow, which investigation has shown to be caused by electric discharges, like the electricity of the electric eel, the raya torpedo, other electric fishes. High microscopic power also detects such moving organisms in those parts of meat and fish that commence to shine in the dark when decay begins to set in. Another cause of phosphorescence may be that the organic cells or animalculæ—whatever they be—during the daytime liberate oxygen by the influence of light, which oxygen remains in solution in the liquid, while the hydrogen, set free, combines with the phosphorus in the fish, forming phosphuretted hydrogen, which in the dark re-oxidizes, and so emits light. This explanation is due to C. Bancel and C. Husson, two French investigators. A third cause is a simple absorption of light during the daytime and emission of the absorbed light at night. Some chemical compounds, such as the sulphids of calcium and barium do this to a high degree; but decaying wood does the same, and often a piece of such wood picked up along the road and taken home will show a phosphorescent glow at night, which however gradually disappears. The most common and permanent of this class of phenomena are no doubt caused by the organisms mentioned at the beginning of this answer.

(2499) Difference Between Liquid Shoe Polish and Boot-Black Paste.—The first difference is that the liquid polish is applied with a piece of sponge and requires no labor to make it shine, while the paste requires vigorous brushing. The second difference is that the paste is most always very injurious to the leather, while the liquid is harmless. The cause of this is the third difference—the shine of the liquid is produced by the gum and sugar, which, when drying, causes a gloss, while the shine of the paste is produced by rubbing, aided by the addition of sulphuric acid, to which some makers add hydrochloric acid and vinegar. Finally, the fourth difference is that the blackening qualities of the liquid consist of the same ingredients as those of ink—gallnuts and sulphate of iron, while the blackening qualities of the paste consist of the same ingredients as those of black paint—ivory black or lampblack, or both.

(2500) Artificial Strawberry and Raspberry Flavors.—The strawberry flavor is produced by mixing 10 parts of acetic ether, 10 of butyric ether, 6 of amyl-acetic ether, 4 of amyl-butyric ether, 3 of glycerin, 1 of formic ether, 2 of nitrous ether, and 2 of methyl-salicylic ether. The raspberry flavor is similar, but contains tartaric acid. The best recipe is to take equal parts of the following ethers: Formic, benzoic, butyric, acetic, amyl-butyric, oenanthic, methyl-salicylic, nitrous, and sebacylic; add equal parts of succinic acid and of aldehyd, 4 parts of glycerin, 5 of tartaric acid, and 6 of acetic ether. You thus see what modern chemistry teaches in this line, and what an array of various artificial ethers and essences it requires; but at the same time experience will show you how admirably the imitations succeed in representing all the peculiarities of the flavors intended—indeed they are so perfect, that it is next to impossible to detect whether they are imitations or not; that is to say, after the flavor has been added to the substance to be flavored, in the required very minute quantities. In large quantities the flavors are not only injurious, but directly poisonous. But so are the natural ones; for instance, the peach flavor distilled from the kernels of peaches is as poisonous as prussic acid, by minute quantities of which it can be imitated. Many chemists hold that the artificial flavors, used in proper small quantities, are absolutely harmless.

(2501) Fire-Proof Preparations.—The best substance appears to be a solution of the tungstate of soda; next are the preparations known for years, which consist of the following ingredients: Sulphate, carbonate or chlorid of ammonium, 6 parts; boracic acid, 2; borax, 1; water, from 30 to 40 parts; to which add 1 part of starch, or ½ part of gelatin may be added. It is not essential to follow the proportions exactly. This solution should be used hot, either by dipping the substance into it or applying it with a brush; in the latter case it is well to put in some pulverized asbestos or soapstone.

(2502) Heat Subtracted by Freezing.—First you must subtract 25 × 28 or 700 units, in order to reduce the water to 32°; then you must abstract 25 × 142 units of latent heat, so as to change the 25 pounds of water at 32° into ice of 32°. This gives 3,550 units; this added to 700 units, gives 4,250 units, which, being nearly equal to 180° × 23⅔, is equivalent to the heating of 23⅔ pounds of water from 32° to 212°, from the freezing to the boiling point.

(2503) Gynecology.—The word, strictly, means "reasoning about women," but as the society you refer to consists exclusively of physicians, their object is the study of that class of diseases to which women are especially subject. If a society under that name were formed by politicians, it would of course have for its object the discussion of the political status of women, and if the leading women's rights advocates took the leading part, it might end in a Gynecocracy.

(2504) Refining Bismuth.—It is recommended to melt the bismuth, and keep it in that condition at the lowest possible heat, for 15 minutes, under the action of a mixture of 3 parts of flour of sulphur, and 8 parts of cyanid of potassium, for every 16 parts of bismuth.

THE MANUFACTURER AND BUILDER.

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Pressure Reducer and Regulator.

There are a very great number of cases where compressed air, steam, gas, water, or other liquids have to be drawn from a reservoir under a constant pressure, while the pressure of the supply varies continually. In the case of steam, there are circumstances under which it is impossible for the most careful engineer to keep the pressure constant. This is the case when steam is used for a variety of purposes, and sudden demands are made upon it, such as, for instance, for heating devices, which at once may reduce the pressure considerably, and by the shutting off of such demand may cause it to rise rapidly again to a degree beyond the requirements.

In the case of compressed air, if drawn from a reservoir, the pressure is at first very great, while during the use of the same the tension, and consequently the pressure, diminishes all the time, until at last it becomes zero. In regard to gas, almost every one knows the inconvenience of changes in the pressure of our illuminating gas; while in regard to water matters are still worse, and the pressure continually changes in proportion to the head in the reservoir, but more so when large supplies are being drawn by individuals; in such cases the pressure constantly changes.

As in many cases a supply of steam, air, gas, or water is required under a constant invariable pressure, a demand has been created for an apparatus that will reduce such pressure to a desired standard, and keep it regulated at that. Various devices have been introduced for this purpose. We take pleasure in illustrating and describing here one of the very best devices of this kind; it is a patent pressure reducer and regulator, as manufactured by Handren & Ripley at their steam engine and boiler works, 126 Washington street, New York. This special form of apparatus is particularly adapted for heating purposes on railroads or in buildings, where the pressure on locomotives or elevator engines is in excess of that suitable for heater coils, thereby endangering the joints and fittings. It may also be employed to great advantage in sugar houses, where a uniform pressure and temperature is required in the vacuum pans; also in distilling oils or spirits, in drying rooms of bleacheries, dye houses, paper machines, or for any and all cases where a uniform and constant pressure is required. It is also admirably adapted to regulate or reduce the pressure in water works between the system of high and low service, where the head requires to be broken either in a line of pipes or between a system of pipes. Another purpose to which it may be adapted is in high buildings where the water tanks are situated on the roof, and where the excess of pressure on the lower floors is liable to burst the pipes, particularly when the cocks are closed suddenly. By the application of this device the pressure can be readily reduced to any point.

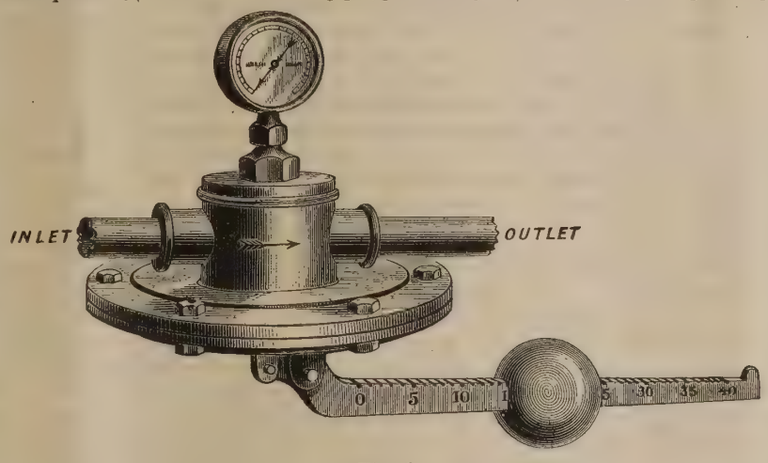

Fig. 1.

In regard to the adjoined illustrations, Fig. 1 represents the exterior view of the apparatus, with a low-pressure gauge attached, which shows the pressure of steam after passing through the valve; the pressure of steam desired can be regulated by the weight on the lever. The comparative size of the apparatus is apparent by a glance at the cut, short pieces of pipe being shown as screwed into the inlet and outlet nozzles, all the different sizes bearing the same proportion to the pipes of supply and delivery. Fig. 2 shows a vertical cross section on a larger scale; it consists substantially of a casing A A, preferably made of brass or steam metal, into which is screwed a cap B; by removing this cap, the valve can be taken out and cleaned from any obstruction. The inlet nozzle upon the casing admits steam from the boiler, or other source of supply, into a chamber C, into which is accurately fitted a balanced poppet valve D D, the opening of which allows steam to flow into the main chamber of the casing, and thence through the outlet nozzles. The degree of opening of this valve D D, and consequently the amount and pressure of steam delivered through it, is governed by the flexible diaphragm E E, which is fastened by a nut F to the lower end of the valve stem. This diaphragm is made of thin sheet brass, steel, or other suitable metal, and entirely closes the bottom opening of the casing, being clamped thereto by a flanged bottom piece G. The area of this diaphragm is so very large in comparison with the unbalanced area of the poppet valve, that a very slight pressure per square inch upon the diaphragm will counterbalance a very high pressure in the chamber C, and will keep the valve closed. Indeed, a half pound pressure per square inch upon the diaphragm will keep the poppet valve closed against a boiler pressure of 75 pounds. As this pressure is much less than is required for any kind of steam heating or effective work, measures are taken to increase and adjust the amount of steam allowed to escape through the opening of the valve, by counterbalancing the downward pressure of the diaphragm by a weighted lever H, which, being suspended upon a fulcrum at I, tends to lift the valve from its seat and admit more steam; this brings a greater pressure upon the diaphragm, which will so adjust itself in position that the pressure upon it will balance the weighted lever. It is evident that this balance will always be maintained, for if on the one hand the boiler pressure should rise, or less steam be used at the outlet, the pressure will momentarily increase upon the diaphragm, closing the valve a little, and so limiting the amount of steam delivered that the balance is again effected. If, on the other hand, the boiler pressure should fall or more steam be used at the outlet, the pressure upon the diaphragm would decrease, the weight would preponderate and lift the valve wider open, and, admitting more steam again, restore the balance of forces. In fine, this apparatus deals with the matter of *pressure* in precisely the same manner as the steam engine governor deals with the matter of *speed*. By shifting the weight

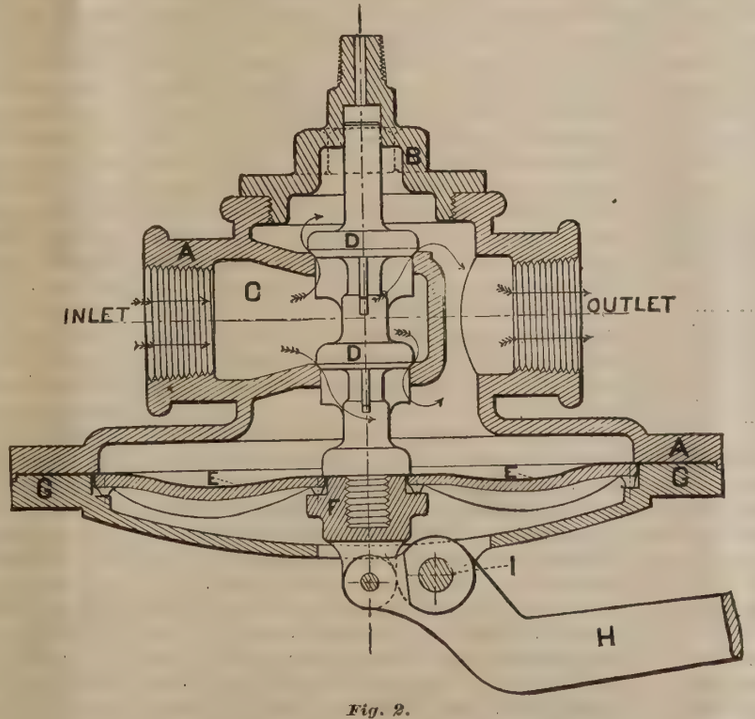

Fig. 2.

upon the lever, any desired pressure less than the boiler pressure can be obtained. A spring is used instead of a weight upon cars or locomotives.

In regard to sensitiveness for changes in pressure, and capacity to prevent them from being communicated beyond the apparatus, we think that it stands foremost in reliability in this respect.

Why there is an advantage and economy in generating steam at a higher pressure, and using it at a reduced pressure, will be explained in our next number.

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This journal has the largest circulation of any mechanical monthly published in the United States. Its value as an advertising medium is therefore apparent.

Vol. XI. No. 11. ELEVENTH YEAR.

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Agencies where the Manufacturer and Builder can be Found on Sale.

The following News Companies in the principal cities of the United States and Canada are agents for the sale of the MANUFACTURER AND BUILDER, and are prepared to supply the same promptly:

American News Company, New York.
New York News Company, New York.
National News Company, New York.
New England News Company, Boston, Mass.
Central News Company, Philadelphia, Pa.
Western News Company, Chicago, Ill.
St. Louis Book and News Co., St. Louis, Mo.
Cincinnati News Co., Cincinnati, Ohio.
Detroit News Co., Detroit, Mich.
Pittsburgh Book and News Co., Pittsburgh, Pa.
Baltimore News Co., Baltimore, Md.
Rhode Island News Co., Providence, R. I.
San Francisco News Co., San Francisco, Cal.
Brooklyn News Co., Brooklyn, L. I.
Newark News Co., Newark, N. J.
Northern News Co., Troy, N. Y.
Albany News Co., Albany, N. Y.
Toronto News Co., Toronto, Ontario, Canada.
Toronto News Co., Clifton, Ontario, Canada.

Special Announcement.

As already announced by circular to our patrons and others all over the country, we purpose making extraordinary efforts during the present season to enhance more than ever the value of the MANUFACTURER AND BUILDER as an advertising medium. To this end we intend to place 25,000 extra copies of the present and two following numbers before those manufacturers throughout the country whom we do not already reach. By manufacturers, we do not only mean makers of machinery and machine tools, but general manufacturers, including wood-workers, iron founders, manufacturers of textile fabrics, etc. The list of addresses in our possession to which we intend sending the copies, includes a large and valuable line of producers. We call the special attention of advertisers to this opportunity to reach a large number of readers in addition to our regular circulation, without extra cost, and we hope to receive a liberal share of their patronage.

Close of the Eleventh Volume of the Manufacturer and Builder.

With the publication of the December number the eleventh volume of the MANUFACTURER AND BUILDER closes, and a very large number of subscriptions expire. In requesting the renewal of these subscriptions, we desire to say a few words to our present subscribers, and also to those whom we hope to have as subscribers the coming year, regarding our future intentions.

In the first place, we shall maintain the same standard in all departments of our journal that has distinguished it in the past, and at the same time will aim to make such improvements as may from time to time suggest themselves.

The rapid progress continually being made in all departments of mechanics and science calls for the largest resources upon the columns of a mechanical journal, to meet which is required the greatest fertility in letter-press and illustration. How fully these demands have been met in the MANUFACTURER AND BUILDER during the many years of its publication, those who have been constant readers of its columns know. Its volumes form a perfect encyclopædia of useful know ledge, and the possessor of a complete set of these has an invaluable illustrated history of the industrial and scientific progress of the years covered by its publication. We have tried to make each succeeding volume of greater and greater value, and the best evidence as to how we have succeeded in this are the volumes themselves. We promise that our next volume shall be a valuable addition to its predecessors, and it will be our aim to add both to the interest of the text and illustration.

A considerable portion of our space will continue to be devoted to the illustration and description of new and novel inventions in machinery and other labor-saving improvements. In the editorial department current topics will continue to be discussed, while the columns devoted to science will form a complete record of the progress being made in this great field. That part of our journal devoted to the illustration of designs will be given a due share of attention, and we take pleasure in stating that we have several features in store for this department which will prove of unusual interest. Our "Notes and Queries" columns—which have always proved one of the most attractive features of our journal—will receive the same care, and we are always glad to receive questions for this department from any of our readers, whether subscribers or not.

In our endeavors we feel assured that we can always rely upon the aid of our subscribers who in the present and past years have so generously accorded us their encouragement. We trust that those whose subscriptions expire with the present number, or with issue for December, will favor us with their renewals, and urge those who are not already subscribers to become so. As an inducement to those intending to become subscribers for 1880, and who send in their orders before January 1st, we will date their subscriptions from the present number, which will entitle them to the November and December issues in addition to the whole of next year—fourteen numbers in all—at the price the yearly subscription—two dollars.

With the revival of business prosperity we anticipate a very large increase to our subscription list the coming year, and the experience of the season, so far as it has advanced, augers well for the realization of this hopeful view. With an increase in our subscription list has also come an increased demand upon our advertising columns, and with better times ahead the MANUFACTURER AND BUILDER will enter upon the coming year with more brilliant prospects than ever, and only asks the kind support of its readers in its efforts to serve them.

Steam Heating as Applied to Cities.

On page 195 of our September number, under the above heading, we gave an article intended to counteract the criticisms of an engineer, published in one of our dailies, and in which the plan was condemned as a monstrous scheme, intended solely for stock-jobbing—as a bubble that "will have to burst long before the last of the confiding fools who put their money into it has been reached by the operators."

We will now make a few additions to what we then said, and at the same time make a few corrections in our figures, which, however, do not affect the general conclusions we arrived at. In the first place, we will state that the Spinola plan of heating the buildings of a whole city by steam has some peculiar features in it, which, from the present knowledge based on theory as well as large experience on the subject, must be considered as defects, but which, if removed and modified according to the teachings of that experience, would eliminate all objectionable features. The principal of these defects is that it is intended not to return the condensed water to the boilers. This involves a waste of water and of caloric, for which there is no necessity. However, such a return of the water from steam heating appliances on a large scale may be considered to offer some practical difficulties; but by proper arrangement this might be overcome, and the advantages gained by a prevention of incrustation of the boilers incident to a continual renewal of the water, as well as by the double economy referred to, would fully compensate for the extra contrivances necessary to secure this return.

Our young contemporary, the *Scientific News*, in commenting upon our article, finds great fault with the statement that 1 pound of coal converts 14 pounds of water into steam, as this would require 13.531 units of heat, while Playfair and De la Beche find the mean total of the heating power of 17 different kinds of English, Welsh and Scotch coals to be 13.044; and then goes on to say: "We should like to know more about this miraculous steam generator. Where is it? Who is the maker thereof?" etc. In answer to this, we say that, according to other authorities, basing their data on more recent and careful experiments, including those made at the Centennial Exhibition in 1876, give the heating power of American coal higher than the results of the older but not so perfect experiments of Playfair and De la Beche. They find for American anthracite 14.500 units; for cannel, 15.080; for Cumberland, 15.400; and for coking bituminous, 15.837, which gives respectively 15, 15.6, 15.9 and 16 pounds of water evaporated for every pound of coal. We will accept the 15 pounds of water evaporated for one pound of anthracite coal, which is almost exclusively used in

New York and its vicinity. We confess that it is the theoretical amount, and that no steam boiler reaches this, and that in our calculation we took the figure 14 and deducted only 7 per cent instead of 13.5, which should at least be deducted to attain the results obtained by practice. This would make the number of pounds of water evaporated per pound of good coal, 12; this agrees with the results obtained by the Babcock & Wilcox boilers at the Centennial Exhibition, as shown in the official report published on page 243 of our November number for 1877. This would increase the figures obtained by us about 13 per cent.

Our critic appears to find our blunders so "grave," that he says: "We are fain to attribute the article to some assistant, rather than to its able and accomplished editor-in-chief." We take the responsibility of having neglected a sufficient deduction from the heating power of the coal; but what must we say of a critic, who, while severely catechising us for what he calls our blunders, is himself careless enough to change the 4,000,000,000 cubic feet of steam, on which we based our calculation, into 40,000,000,000 cubic feet, and thus obtains 24,390,243 cubic feet of water instead of 2,439,024, and 182,439,017 gallons instead of 18,243,902. Finally, an average evaporation of 271 cubic feet for each of the 90,000 buildings in the city, instead of only 27 cubic feet.

We will now take the 18,243,902 gallons of water required per day, (on the estimate of the 4,000,000,000 cubic feet of steam wanted); multiplying it by 7.5, to reduce it to pounds, we have 137,000,000 nearly; this divided by 12 pounds, the amount of water evaporated by 1 pound of coal, gives 11,400,000 pounds of coal for 90,000 houses, or about 126 pounds of coal per each house per day; so that a ton of coal would furnish steam for each house for 16 days, or 8 tons for 128 days during four winter months.

This corrected result does not show so great an economy as we calculated before, but still bears a favorable comparison with the average consumption of coal for cooking and heating in a large dwelling house. But it must, above all things, be considered that the 4,000,000,000 cubic feet of steam which "An Engineer" adopted, and on which we based our calculation, may be an exaggerated estimate, and we made the calculation that even at this exaggerated estimate the cost would not be enormous after all.

In a future number we will give another estimate of the economy of steam heating, based on the practice of those who make this business a specialty.

Improvements in Gas Manufacture.

It required some extraordinary events to rouse the apathy of gas companies toward anything that would tend to improvements in the methods of manufacturing or of consuming gas. We can speak from personal experience which we obtained in 1860, when doing our best to obtain a hearing, or to show a most interesting experiment to any one interested. But stockholders were deaf to our entreaties, and at the companies' offices they would not even look at our experiment, notwithstanding it would have taken only a few minutes to do so. At the office of the Manhattan Gas Company, corner of Irving Place and 15th street, we were even treated in such a peremtory manner that we concluded to leave for fear of being ejected as an intruder.

Things have changed since then, and in many offices they now keep several kinds of gas stoves on exhibition, to show consumers the advantages of using gas for cooking and heating purposes—an application of gas which we in our household have employed for the last 30 years. In the various gas works extensive experiments are going on with the intention of improving the manufacturing processes in regard to the quality of the gas produced, and economy in its production.

What has wrought these changes in the management of the gas interest? Nothing but the fear of competition from the electric light. Our readers are aware of the exaggerated expectations which were circulated some time ago, that electric light would entirely supersede gas light, that it was so cheap as to cost almost nothing, that all the gas companies were to be ruined, and could sell out all their large and costly gas-holders, retorts, purifyers, etc., for scrap iron. Gas stock actually fell, in the same way that fancy stock often falls in Wall street, and many rash people sacrificed their interest, while others profited by the event. This, and nothing else, was what caused the gas companies to look about for improvements in order to secure profitable returns from the capital invested, even when the charges to consumers had to be largely reduced, and at last it was concluded to listen to those scientists and patentees who know something about gas-making. Now they have found a favorable hearing, and a chance is at last given them not only to explain and exhibit, but to try various devices at the gas works.

It is only natural that as long as capitalists obtain large returns from their investments, they are satisfied; this was especially the case with those who had invested in gas stock, who only feared that any new method might diminish their profits. They went by the old maxim, "Let well enough alone," and it was let alone until the electric light panic (which especially in England created much speculation) put an end to their inertness.

The reforms now being introduced include the improvement of the gas itself in regard to purification and greater light-producing qualities, as well as to economy of production. In regard to the former, the process of Orazio Lugo, namely, purification by bone-black, promises important results, as the amount of gas which a comparatively small quantity of this remarkable substance can purify is simply enormous. In regard to the cheaper production, the method of making water gas by blowing superheated steam over white-hot coal, and then enriching it with petroleum vapor, appears to be the most economical, and is now in successful operation in this city, and is being introduced in Brooklyn and other places, as we have announced on a former occasion.

Humbug No. 5.—The Chambers National Lightning Protection Co. of Cincinnati.

A company calling itself the Chambers National Lightning Protection Co. of Cincinnati, Ohio, has lately patented a new method of putting up lightning rods, which is nothing but a confession of ignorance on the part of the patentees in regard to the laws of electricity. This new patent lightning rod consists of a horizontal rod running over the ridge of the building, with a point at each end projecting upward, while it is supported on large glass insulators, and has no connection whatsoever with the ground.

The patentees evidently do not know that a stroke of lightning from a cloud to the earth is nothing but the neutralization of two opposite states of electricity —a positive electric cloud and a negative electric earth, made strongly so by the well established law of mutual induction. Every time the electric spark flies over between the two, a part of the charge becomes neutralized, and this neutralization can only take place by the earth receiving the electricity from the cloud and the cloud receiving the opposite electricity from the earth. Frequently these explosions take place between clouds mutually, as often some clouds are positively charged and others negatively; for this we do not want lightning rods; but when the discharge takes place between the earth and the clouds, and a house, tree, or man happens to be in the path of the discharge, the effects are often very destructive. Now, as an electric current prefers a metallic path, metal being a better conductor than any other substance, it is advantageous to give the lightning such a path, by making a metallic connection between the moist and conducting earth below and any spot above where the lightning is likely to fall in its downward course to the earth. Such a metallic connection is a lightning rod, not the point above, which may even be omitted; neither is it necessary to isolate it from the building with glass supports, as is done by ignorant lightning rod men; on the contrary, it should be connected above with the metal of the roof of the house, so that should the lightning strike the roof, it will find through the rod at the side of the house a ready downward path to the earth, without damaging the building. A good earth connection is the principal thing, upon which the greatest care must be bestowed; this is often neglected, and has proved to have been the cause of the failure of many lightning rods to give the expected protection.

Now this ground connection—this most essential feature of all lightning rods—is intended to be left entirely out by the learned Chambers National Lightning Protection Co. of Cincinnati; not only this, but the lightning rod is isolated. The result must be that if a stroke of lightning strikes such a rod from a cloud say 2,000 feet above the house, and overleaps a space of 2,000 feet through the air, it will also easily overleap the 100 feet or less between this new fashioned patent (so called) lightning rod and the ground, and the house, being in its path, will suffer, and the people in it may suffer also.

There is a journal issued by the Iowa Agricultural College, in which recently Prof. Macombes of that college is seriously questioned as to the possibility of protecting a house against lightning by isolating it on glass legs. How stupid! as if a stroke of lightning which descends from a cloud, perhaps half a mile above the roof of the house, could not overleap the distance below the house to the earth, even if the glass legs were 20 feet high.

The Hudson River Tunnel.

The shaft for the Hudson River tunnel, in Jersey City, has been sunk to the full depth—65 feet. At 40 feet depth the water began to flow in so rapidly that powerful steam pumps were required to keep it dry; another pump has now been added, and the sideward and slightly downward digging in an easterly direction, for the tunnel itself, has been commenced. On the New York side property has been secured between Bleecker street and Washington Square, not far from Broadway, for the New York entrance. A shaft will be sunk at the foot of Morton street, to about the same depth as that in Jersey City, when from its bottom in a westward and also in a sideward and slightly downward direction, digging will begin, and the work pushed forward from both sides simultaneously, with three gangs of men, working night and day, which, for such kind of work, is true economy, as the pumps have to be kept going all the time anyhow.

The incline in Jersey City to reach the tunnel with the railroad trains, will begin at the corner of Jersey avenue and Fifteenth street, 3,400 feet from the river shore; the tunnel itself will be 5,400 feet long, and the New York incline 3,000 feet, so that the whole length will be nearly 12,000 feet, or about 2¼ miles.

The walls will be circular, 3 feet thick, and built of hard brick and hydraulic cement; the tunnel will be lighted with gas, and contain a double railroad track. Freight trains will be chiefly run at night and passenger trains during the day, all drawn by locomotives using compressed air, which will at the same time ventilate and cool the tunnel. Over 400 trains will pass daily; it will be a great boon to travellers, who will be enabled to reach New York independent of delays by ferries, which, on account of fogs and ice, are not infrequent.

Favorable anticipations prevail in regard to the successful completion of this great work, as most of the soil consists of a tenacious, silty clay, underlaid by hard-pan. On the New York side there is some gravel, and a small extent of rock, like that at Hell Gate, but no difficulty is anticipated from this.

We wonder if any money will be wasted in trying the foolish original plan of its engineer, Col. De Witt Haskin, to keep the water out of the tunnel by sideward air pressure, of which we explained the absurdity in our numbers for May, 1875, and September, 1876.

Improved Safety Valves.

The main defects in the ordinary safety valves are that they are so unreliable about opening when the desired pressure is reached, and when blowing off their lift is so slight, that they do not begin to discharge steam until the pressure has risen considerably above the point at which they are supposed to be set. This is caused by the friction of levers, pins, etc., of which they are composed, and by the sticking of the valve to its seat—the result of corrosion. Then when such valves begin to blow off, they do not rise high enough to give exit to the surplus steam which may be generated instantaneously, and cause the explosion of the boiler at any moment. It is evident that such valves do not deserve the name of "safety valves," and ought to be discarded as unreliable and unsafe, and treated as a relic of the past, no longer worthy to be classed among modern safety appliances.

The result of employing such unreliable safety valves is graphically illustrated in Fig. 1, which represents the bursting of the boiler of a portable engine, such as used for agricultural purposes. The result is by no means overdrawn, as will be testified to by all who have ever witnessed a boiler explosion, or the wreck of one shortly after it occurred. It is a serious warning in regard to the use of proper safety valves, the case here represented being one where the safety valve did not blow off in time, and did not lift sufficiently to permit the escape of the steam.

Fig. 1.—RESULT OF DEFECTIVE SAFETY VALVES ON BOILERS.

The valves represented in Figs. 2, 3 and 4 are guaranteed to be free from the defects referred to, and will blow off at the exact pressure intended, and when blowing, they lift high enough to present an area of opening for the escape of steam capable of preventing any increase of pressure in the boiler. They are manufactured by the Consolidated Safety Valve Company, of 51 and 53 Sudbury street, Boston, Mass. These valves are so much appreciated by master mechanics, locomotive and other engineers, that over 35,000 of them are now in use in this country and in Europe.

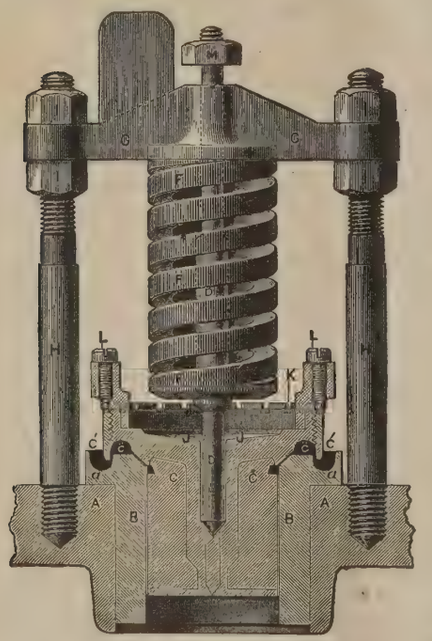


Fig. 2.—Richardson's Adjustable Lip Safety Valve as Attached to a Locomotive.

Fig. 4.—Brass Case Lock-Up Safety Valve.

Fig. 2 represents the Richardson adjustable lip pop safety valve, well known to all locomotive builders, and in use on most all the railroads in the United States.

Fig. 3 is the Ashcroft nickel-seated non-corrosive safety valve, which cannot corrode or stick in its seat; it has been approved by a board of United States naval officers, appointed to test its operation and merits, and by its recommendation adopted for all the marine and land boilers of the United States government.

Fig. 4 is a new style of pop safety valve, neat and compact, intended for use on portable, locomotive, farm engine, hoisting engine, and other boilers. It is arranged with a desirable lock-up attachment, effectually preventing it being tampered with or its blowing off point changed by any unauthorized person. As farming and hoisting engines are often left unguarded, or in charge of persons who do not realize the danger, such a safety valve gives a perfect sense of security to the owner, or the person in charge of such boilers. The action of all these valves is so prompt, and their lift so great, as to prevent any increase in pressure above the desired point in any boiler to which they are attached, even if the throttle valve is closed and the dampers open, and a strong fire raging in the furnace.

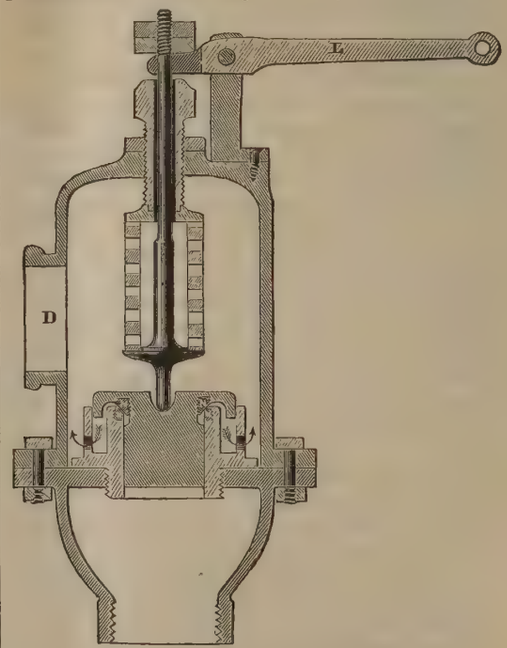


Fig. 3.—Ashcroft's Iron Case Nickel-Seated Non-Corrosive Safety Valve.

Parties ordering these valves, must of course state

the steam generating capacity of the boiler and the pressure at which they wish the valve to blow off.

The company (of which Chas. A. Moore is President and General Manager, Martin Luscomb Treasurer and Secretary, and Geo. W. Richardson Superintendent) will furnish illustrated catalogues on application.

Improved Vertical Engines.

We take pleasure in placing before our readers representations of two improved vertical engines of new design, and of a quality second to none in the market. They are of a new and graceful design, and evidently, for the amount of material used, give a maximum degree of rigidity and strength, so necessary to freedom from vibration and consequent power of resistance to wear and tear, all highly essential to durability, and securing true economy in the end, even if these engines were of a higher price than others of the same power, which they are not, but in fact cheaper, a 10 horse-power engine costing only $250, and one of 30 horse-power $400.

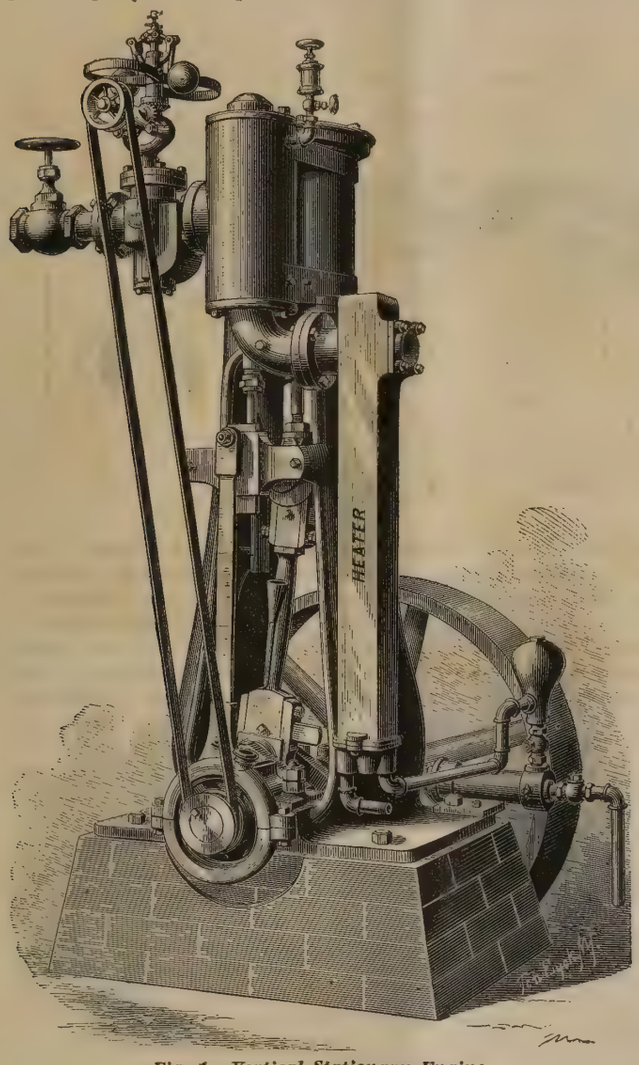


Fig. 1.—Vertical Stationary Engine.

Fig. 1 is a stationary engine, with fly wheel, intended for manufacturing purposes, to be placed upon a solid base; while Fig. 2 is intended as engine for a yacht, and especially adapted to small steamers, canal craft, pleasure boats, etc.; it has, of course, no fly wheel, but a reversible link motion, as shown in the engraving. The smallest of these engines have cylinders of 8 by 8 inches, and the largest 12 by 10 inches; the fly wheels of the engines represented in Fig. 1 are from 36 to 42 inches in diameter, make 200 revolutions per minute, and weigh from 500 to 900 pounds, while the whole engine weighs about four times as much, and is from 5 to 6 feet high.

In regard to details of construction, we can state that the working strain, acting on a line through the center, is entirely self-contained, rendering it practically impossible for these engines to get out of line. Requiring a very small floor space, they are more compactly built than any other horizontal engine of equal power, and from shortness of stroke and great strength of parts, admit of a very high rate of speed. The cylinder is steam jacketed, with a steam chest on the bottom, giving perfect and instant drainage, all being cast in one piece. The piston is packed with self-adjusting inside and outside metallic rings; also the valve, which, while simple and inexpensive in construction, gives results equal to any not supplied with variable automatic cut-off. It is as perfectly balanced as one running in a horizontal position can be made, and requires the minimum of power for its operation. It exhausts through its center into the heater, giving no pressure on the steam chest covers, or leakage at any point. The feed pump is simple, positive, durable, and accessible, in case of stoppage, by simply loosening one nut, without disconnecting the pipe. The water heater is separate, and so attached as to have no effect from its expansion and contraction on other parts, and has perfect drainage.

We wish to add that the low price of these engines is due to the fact that all work of a showy and ornamental nature, which enters largely into the cost of more expensive engines, and all complicated and expensive mechanism for operating the valves, etc., have been dispensed with. These things, while adding greatly to the cost, do not, of course, add to the actual value of the engines for practical purposes, and as engines of this class pass largely into the hands of those quite inexperienced in their attendance, it is far better that complicated and expensive mechanism should as far as possible be avoided.

These engines are made by Heald, Sisco & Co., of Baldwinsville, N. Y.

Edson's Indicating and Recording Safety Gauge and Electro-Magnetic Alarm Attachments.

Manufacturers and proprietors of establishments in which steam boilers are used, also all the incorporated Water Boards who wish an automatic check or a detecter of wrong doing, either by waste of water or misuse of the same, are indebted to Mr. M. B. Edson for a most ingenious and valuable instrument, in the use of which the proprietor or manager can be seated in his private office, quite a distance it may be from the engine and boiler, and yet know precisely the steam pressure maintained by the engineer. By means of a mechanical arrangement, operated by clock-work, a continual record is obtained of the pressure, and a pencil traces on a diagram slip, placed in the gauge, the variations of pressure at every hour of the day and night. The instrument is connected with the boiler by an ordinary steam pipe, and if the gauge be not on the same level with the boiler, a little correction is to be allowed, amounting to one pound for every two feet vertical rise or fall, in order to balance the hydrostatic pressure of the water column in the connecting pipe.

In addition to the pencil recording the pressure, a hand and dial also indicate the amount of steam or water pressure, while an alarm gong is started as soon as the pressure reaches a certain limit (which may be variously set), according to the requirements of the proprietor. A vibrating gong may be rung simultaneously in various places by means of electric attachments, and by these means panics will be prevented and loss of life avoided. The "cuts" of the daily "charts" are half size of originals, the horizontal lines being a scale of pressure, and the vertical lines denoting the hours of day and night. The records are torn off daily and filed away.

Thus does the recording gauge act as a vigilant and perpetual watchman. Uniformity of motion and temperature, economy of fuel, and avoidance of risk from either carelessness or incompetency, are all secured by the use of this instrument, which possesses an intelligence that seems almost human. This gauge is in use not only in numerous mills and factories throughout the country, but may also be found on board of the vessels of several ocean steamer lines, in the Austrian and British navies, in hotels, public buildings, charitable institutions, city water works, etc.

The importance of an efficient gauge as a means of indicating approaching danger, can scarcely be overestimated. With an instrument such as we have described, properly adjusted and kept in order, which not only points to the danger, but speaks in clear, ringing tones when it approaches, there need be little fear of steam boiler explosions, if careful inspection and proper attendance are insisted upon. The self-recording steam gauge and high-pressure alarm is made and sold only by the Edson Recording Gauge Manufacturing Company, 91 Liberty street, New York, to whom all inquiries with reference to the instrument should be addressed.

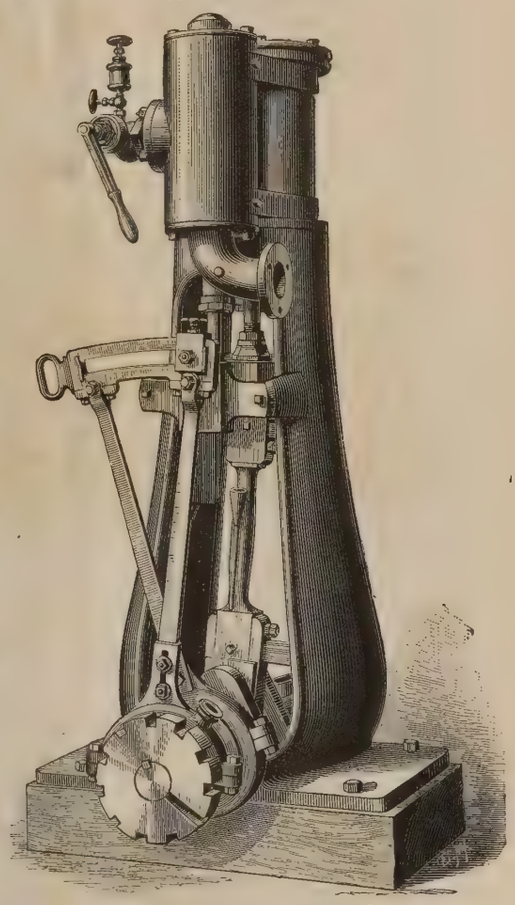


Fig. 2.—Vertical Yacht Engine.

The Future of New York City.

It is reported that capitalists are warned by Prof. Merriman against investing money in New York city real estate. It has been proved that the island is sinking at the rate of 3 inches every century, so that in 10,000 years it will be 250 feet under water, consequently only the tops of Trinity church tower, the shot towers, the stand pipe of the engine at High Bridge, and a few other equally high points, will then be above the water. As under such circumstances it will be very difficult to find tenants for the houses, or to collect rents and interest on mortgages, real estate will not then be very desirable property.

Steamboat Boiler Explosion.

We will have to treat our readers to another boiler explosion, chiefly for the reason that it presents features very different from other explosions described by us, and teaches some lessons equally as valuable to proprietors of boilers and engineers as to boiler makers. It was the lobster-back boiler (29 feet long by 12 feet wide) of the side-wheel steamer "Adelphi," running between New York city and Norwalk, Conn., which, in exploding, made an opening of more than 20 square feet, through which the entire contents issued at a velocity corresponding with a pressure of 40 pounds, carrying away 20 feet of each of the three decks of the vessel, and everything thereon; timbers reduced to splinters and joiner-work to fine kindling-wood, went flying high into the air, with 41 persons, of whom 15 were killed outright.

Fig. 1 represents the boiler in outline after the explosion; A E F C is the opening made, through which the vertical stays are visible. It will be seen that there were three furnaces, of which Fig. 2 shows the interior details, and Fig. 3 a vertical section, with the vertical stays and their attachments, while Fig. 4 is a section of the front part, with the tubes, through which the products of combustion returned to the smoke stack, placed half-way on the boiler, as seen in Figs. 1 and 2. In Figs. 3 and 4 the dotted circles at the left, around E as the center, show the way in which the sheets were turned up by the explosion, while Fig. 5 shows the weak spot on a large scale where the first fracture took place.

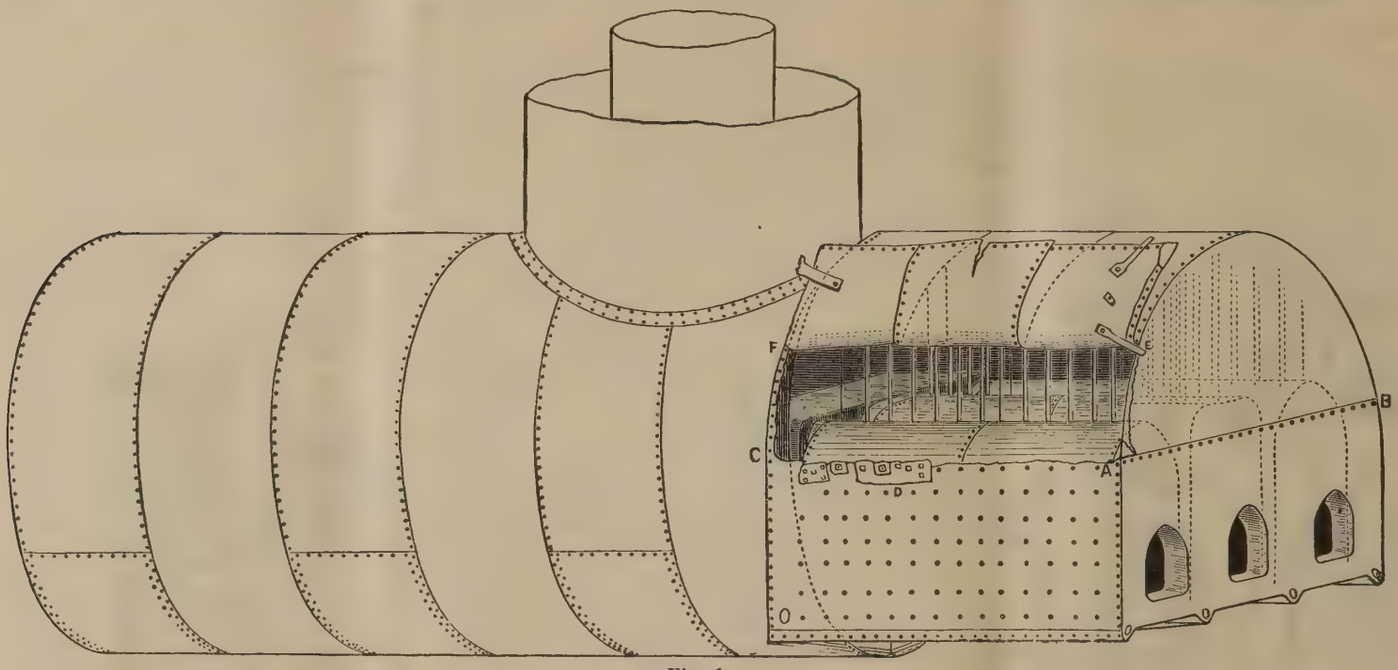


Fig. 1.

The boiler was built in 1875, of lawful iron, and fitted with the necessary attachments for indicating the hight of the water and the pressure of steam, and was allowed to carry 40 pounds and no more. A patent locked safety valve, and one of the common lever kind, are fitted to the tops of the steam chimney, and directly beneath them, to the side of the steam chimney, is attached the main steam pipe. Just above, within the smoke chimney, is located a steam jet for increasing the draft. It consists of eleven steam pipes arranged horizontally across the chimney in the form of a triangular pile; each pipe on its top side has a number of small jet nozzles pointing upward. This apparatus is supplied with steam direct from the boiler through a 2½-inch pipe, the valve of which is set full open when the full power of the boiler is required.

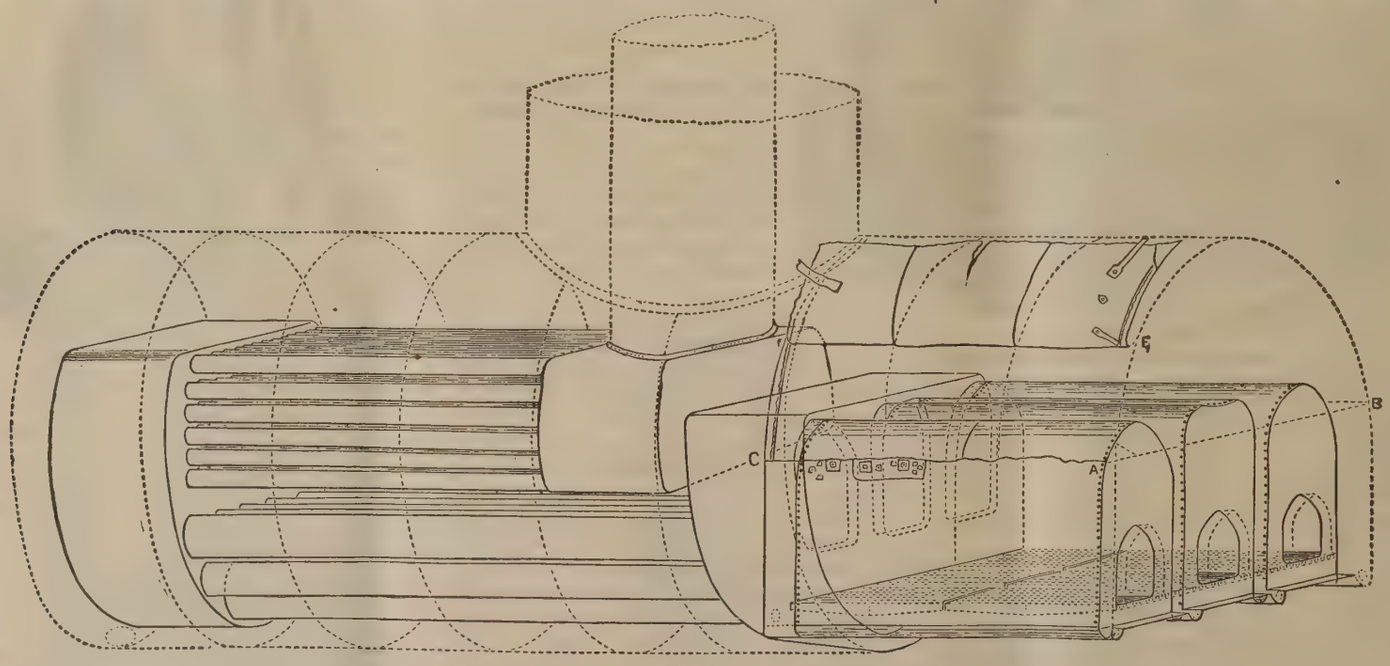


Fig. 2.

For the purpose of facilitating the circulation of the water within the boiler, a wrought-iron pipe about 5 inches in diameter is attached to each of the back heads of the body in line with the lateral water legs, and extends alongside the barrel to the last course of sheets curved under the bilge of the barrel, where it is attached to the upper part of the head of a cast-iron cylinder, on which, looking toward the center of the boiler, and bolted to the shell, is a flanged nozzle opening into the water space that surrounds the back smoke connection; communication is hereby established and a current maintained between the stagnant water in this cool part of the boiler and the most active generating surfaces. The chamber of the cast-iron cylinder serves as a mud drum, and, having the blow-out pipes attached, less waste of heat is said to occur by occasionally opening the blow-cocks to discharge the sediment, than would happen if the same quantity of mud were drawn directly from the more diluted mass in the boiler.

A pipe of boiler iron, about 8 inches in diameter, is placed horizontally across the back connection a little below the center, which forms a communication between the water spaces at each side, and is intended to

heat the feed-water, a portion of which is delivered by the starboard pump into the corresponding end of it. The other pump delivers water to the port side of the body, near the back head, and 10 or 12 inches above the plane of the fire grates.

It does not require an expert to detect the immediate cause of this disaster. The ragged and thin edges of the plates showed plainly the effect of the insidious boiler malady—internal corrosion; and on what may be termed a *post mortem* study of the structure, the more remote causes are not so very difficult to arrive at. The groove or furrow in the plate is adjacent to the upper line of the socket stays and along the inner lap of a long seam. The springing of the plates above, caused by the sudden variations of internal pressure as each charge of steam is taken by the engine, has formed a joint, such as would happen to a piece of iron held in the jaws of a vise and bent back and forth, while at the same time a heavy tensile strain was applied. This line of disturbed fibers is especially susceptible of the oxidizing action of the water. While at rest, the weakened line becomes coated with oxid, which is cracked off by the motion and washed away by the currents when the boiler is put to work again, leaving the clean and weak fibers more susceptible, and by reason of their loss of substance less capable of bearing the strain. And the destruction goes on in an increasing ratio until the furrow comes through, or the plate cracks, (as in this case it did), and begins to leak. Cracks in the shell, or other parts of boilers not exposed to the direct action of the fire, may be regarded as unmistakable signs of distress. But to the engineer who has not had the advantage of studying practically the causes of destructive explosions, and knows little about boilers outside of his own practice, this phenomenon means no more than any one of the many leaks that he has successfully patched before. So it is duly patched, as seen at D, Fig. 1, and afterwards admirably endures the legal hydrostatic test; but the "plasters" only hide the defects—the work of destruction still goes on. The extra expansion of the furnaces, both laterally and upward, tends to assist in forming the fatal joint; the former by thrusting the sides outward and bending them sharply on the inner lap of the seam, and the latter by loosening the vertical stays, thereby throwing undue strain upon this weak line; altogether placing the parts under consideration in favorable condition for rapid oxidation, which, having gone on to maturity, a slight shock only is necessary to burst open the door.

Other weak points existed in this boiler, which ultimately would have wrought its utter destruction had this weak part been made to outlive them, but as they did not affect the durability of the part that failed, the discussion of them may properly be omitted here. A hint, however, at the unusual number of patches that had from time to time been put on this boiler shell, and notably the three or four at the base of the steam chimney, may be admissable as a warning.

The boiler had been inspected by the United States Assistant Boiler Inspector, and his certificate that everything was in good and safe condition was in the hands of the owners of the boat. The law setting forth the inspectors' duties reads thus: "Where flat surfaces exist, the inspector must satisfy himself that the bracing, and all other parts of the boiler, are of equal strength with the shell, and he must also, after applying the hydrostatic test, thoroughly examine every part of the boiler to see that no weakness or fracture has been caused thereby," etc. From the evidence before the coroner's jury it was ascertained that the inspection of the boiler was made with fires in the furnaces. It will be readily seen that, under these circumstances, no internal examination of the boiler could have been made at the time. The certificate of inspection which was issued stated that the longitudinal seams of the boiler were double riveted, which was not the case. This is not mentioned as an error that had any direct bearing upon the explosion, but to show that the inspection must have been very carelessly made.

The local inspectors of steamers sailing from the port of New York investigated the case, and reported as follows on the inspection and responsibility of the owners: "John W. Blake, late Assistant Boiler Inspector, who made the last inspection of this boiler, we find performed that duty in a very negligent and imperfect manner. His inspection was made with fires in the furnaces, (in violation of instructions from this Board, issued under date of February 11, 1878), which precluded the possibility of making a minute and careful examination even of those parts of the boiler which were of easy access—depending on the statements of the engineer and the age of the boiler for its condition. It appears, from his testimony, that he knew nothing of the character or condition of the bracing within the boiler; he did not know whether there was more than one safety valve attached to the same, and he did not know whether he set the safety valve to blow at the pressure allowed, or at what pressure it would blow. The conduct of Mr. Blake in this case is without excuse. Three steamboat boilers inspected by him this season had previously exploded with the loss of many lives, which should have been a warning to him to be more particular and thorough in his examinations; but it appears that these fearful occurrences had no effect in stimulating him to greater care and diligence. After a careful review of the testimony in this case, we are of the opinion that Mr. R. C. White, the owner of the steamer, was actuated wholly by a desire to comply in all respects with the requirements of the law, and to have all necessary repairs made with promptitude and in the best manner."

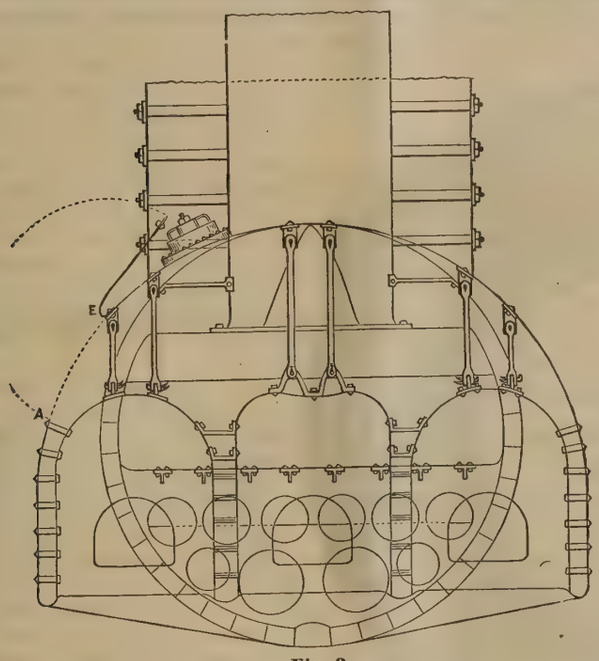


Fig. 3.

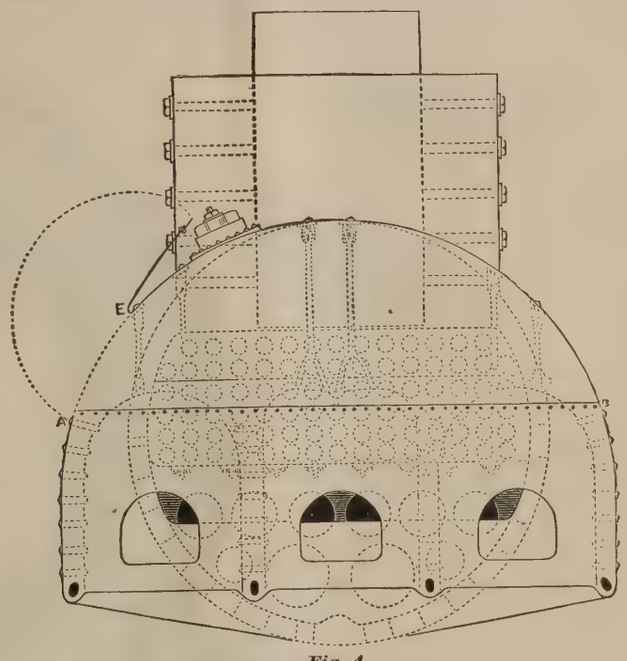


Fig. 4.

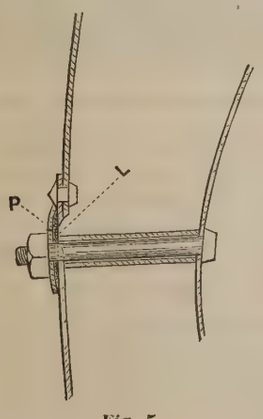


Fig. 5.

The engineer and inspector were indicted for manslaughter, and the case was carried into the United States Circuit Court. The evidence against the engineer was not considered sufficient for conviction, and a verdict of acquittal was promptly rendered by the jury. The case of the inspector was thereupon *nolled* by the prosecuting attorney, on the ground that the evidence was the same in both cases. This proceeding of the attorney was something of a surprise, as the people who had given the case attention were satisfied that the evidence would not be the same in both cases.

We are indebted for the above illustrations and details to the Hartford Steam Boiler Inspection and Insurance Company, who have kindly furnished us an advance copy of their report on the matter.

The lesson conveyed by this accident is, that it is far safer to trust to the inspectors of that company than to those of the United States, and this for the simple reason that the United States does not pay damages for the bursted boilers which their inspectors examine and approve, and therefore have nothing to lose if the inspectors are negligent of duty; while the Hartford company hold themselves responsible for the consequences of neglect in inspection, hence the conscientious performance of duty. It is simply the difference between a duty performed by irresponsible or by responsible parties.

Sturtevant's New Steam Fan.

One of the special products of manufacture which have attained in the United States an extension unparalleled in the rest of the world, is undoubtedly the manufacturing of fan blowers by Mr. B. F. Sturtevant, of Boston, at Jamaica Plain Station, on the Boston and Providence Railroad. The most rapid progress in these works has been since the introduction of the steam fan represented in the adjoined engraving, requiring no belt from a steam engine to drive it, but adapted to be driven by the steam directly, very important and advantageous under many circumstances, easily understood, and which therefore it is not necessary to enumerate.

The general approval of this form of fan blower, notwithstanding it is of recent invention, has already been such that the manufactory has become so crowded with work as to exceed the extensive facilities with which they can produce them, rendering their exhibition at any of the expositions impossible, as none could be produced ahead of orders, and necessitating large extensions to the works, with additional machinery and an increase in the already large force of skilled workmen; all this in order to supply the demand and satisfy orders as promptly as they should always be supplied.

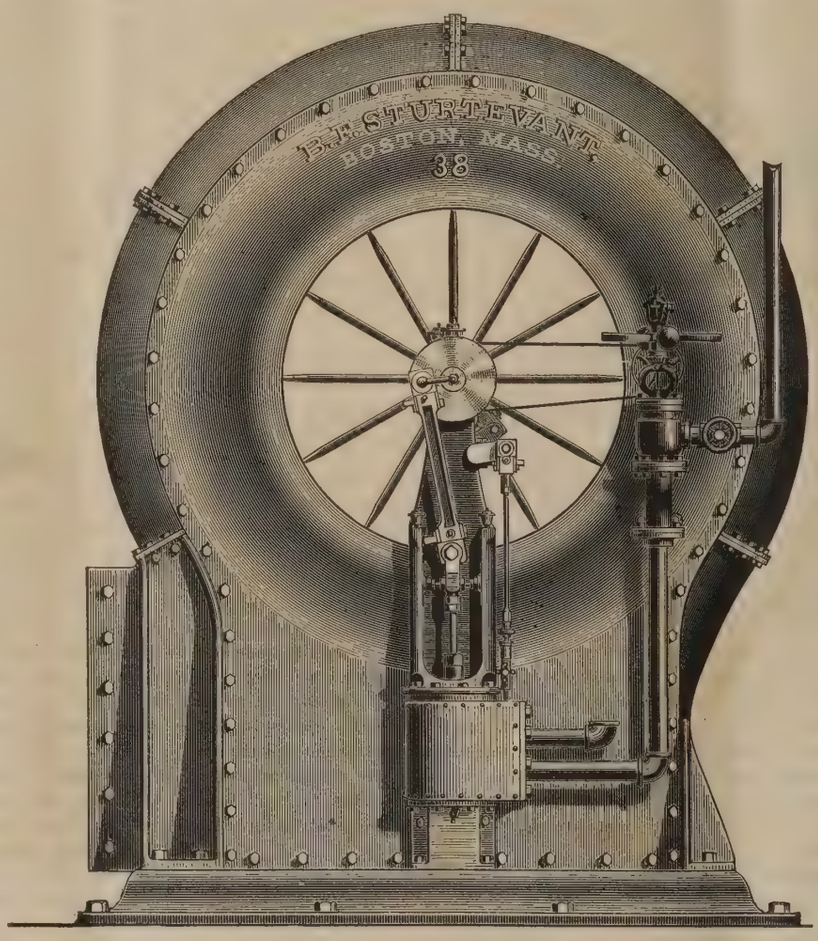
The blowers of Mr. Sturtevant are used in the Capitol and all the departments at Washington, and in government works in different parts of the country, while recently such a steam fan as here represented was furnished, with double engine, for the United States gunboat "Miantonomah," and four more are being built on contract for the same vessel.

These blowers are made of ten different sizes, and varied according to the requirements of customers, besides special sizes, ranging in capacity from 100,000 to half a million cubic feet per minute. They are made to discharge horizontally at the bottom or top, up or down, from either side, at an angle up or down, as the locality may require. The same sizes are also made with pulleys, to be driven by belt from a line shaft or from a separate engine.

These fans are adapted for blowing furnaces of all kinds, such as are provided with grate bars, and especially for steam boilers, puddling and heating furnaces. Coal screenings and all kinds of refuse coal may be successfully used for fuel by the aid of these fans to create a blast; for forcing fresh air into, or taking foul air out of coal mines and other places needing ventilation, such as hospitals, asylums, theaters, and other public buildings, manufacturing establishments, etc.; also for numerous other uses where large volume of air is required.

In regard to the numerous special varieties of blowers manufactured by Mr. Sturtevant, we may divide them into: 1st, pressure blowers; 2d, exhaust fans; 3d, pneumatic despatch blowers; 4th, hot blast blowers; 5th, steam heaters and blowers, combined; 6th, cold blast blowers; and, 7th, condensers.

1st. Pressure blowers are used for blowing forges of all sizes and kinds for working iron and steel, gold, silver, and copper; also for blowing reverberatory furnaces, heating and puddling furnaces and nobbling fires. This blower is also used for blowing furnaces, for melting steel and other kinds of metals in crucibles; cupola furnaces for melting iron, brass and copper; for steam boiler furnaces where fine coal is used, and especially where coal dust or screenings, or wet tan bark or sawdust is used for fuel. In addition to burning cheap fuel, the blower adds to the capacity of the boiler for making steam, by means of the more rapid currents through the tubes. The pressure blower is also used for supplying jets of air, or open air blasts for blowing on to and cooling hot molds in the manufacture of glassware, for cooling men and women who are compelled to work very near hot furnaces and forges in glass and iron works, hotels and restaurants, especially in hot climates. By aid of a blower a man or woman may be kept very comfortable within two or three feet of a red-hot furnace or cooking range. These blowers are also used to give jets of air for blowing sawdust from logs in front of saws, thereby preventing the saw teeth from clogging. The construction of these blowers is such as to adapt them to all varieties of speed and power, and for every possible duty. The sizes range from 250 to 500,000 cubic feet a minute, the largest being two thousand times larger than the smallest. The sizes which exceed the capacity of 50,000 cubic feet a minute are not built portable, the housing being constructed of brick, stone, or wood.



STURTEVANT'S NEW FORM OF FAN BLOWER.

2d. Exhaust fans are employed for removing shavings from planing and molding machines; sawdust and dust from sand wheels, such as are used for polishing lasts, carriage spokes, shoe bottoms, felt hats, etc., and emery wheels for polishing all kinds of hardware; smoke and gas from smith shops, manufacturing establishments, and chemical works; steam and vapor arising from paper machines, drying cylinders, and dry-rooms; also sweat from mill stones, offensive odors from try-kettles and dyeing establishments, dust from rag and cotton pickers, flax and rope machinery; ventilation of coal mines and underground apartments and cellars; and for exhausting impure air from public buildings of all kinds. Two of these fans are already in use in the United States Senate Chamber, and two in the House of Representatives, being driven by very powerful engines, and capable of removing 1,800,000 cubic feet of foul air per hour.

3d. Pneumatic despatch blowers are arranged for conveying and elevating small packages.

4th. Hot blast blowers are used for taking the hot, volatile product of combustion from large boiler chimneys, and forcing it into kilns for drying non-combustible materials, such as fertilizers, brick, etc.

5th. Steam heaters and blowers (combined) are employed for blowing under beds of wet wool and cotton, and also cotton waste and wadding; into machines for drying wet cloth and hosiery; into kilns for drying lumber of all kinds, staves for barrels, tubs and pails, clothes pins, brick, grain, tobacco, sliced fruit and vegetables of all kinds; chemicals, glue, and gunpowder; and for drying leather and skins in tanneries. These machines not only supply the necessary heat for evaporating the water from the substance to be dried, but the great energy of the blast expels the moisture from the dry kilns, keeping them thoroughly ventilated and filled with dry, hot air.

6th. Cold blast blowers are used for drawing currents of air through boxes filled with cakes of ice applied to refrigerators and chill rooms in markets, hotels, on board cars and steamships, for the preservation of fresh meat during transportation, etc. These are generally termed exhausters, being provided with a supply pipe leading from the boxes to the blower, and are also extensively used in slaughter houses for cooling purposes.

7th. Condensers for condensing the moisture in the air, rendering it comparatively dry, cold, and free from fungus. These condensers are usually constructed of coils of pipe filled with cold running water, over which the air currents are forced by the blower. They are also constructed on the same principle as surface condensers on board steamships, the air currents being forced through a large number of tubes surrounded by cold water.

The adjoined engraving is so plain that it almost explains itself. The crank of the driving engine is short, consequently the stroke, and the engine therefore essentially adapted for rapid motion; a governor moderates the speed by regulating the supply of steam, while in the direct action of the engine upon the machine to be driven, a decided economy is obtained by the absence of pulleys and belts.

The following is a list of only a few of the large number of establishments where the Sturtevant blowers are used with perfect satisfaction: Havemeyer & Elder and Havemeyer Bros., sugar refiners, Brooklyn, N. Y.; Durant & Sons, sugar refiners; P. Lorillard & Co., tobacco manufacturers, and E. Frank Coe, fertilizers, New York; Coe & Richmond, Atlantic Refining Co., refiners, and Bader, Adamson & Co., Philadelphia, Pa.; Susquehanna Coal Co., coal, Nanticoke, Pa.; Troy Steam Heating Co., steam power, Troy, N. Y.

From among these we have seen many testimonials, but only have space for one. We give it in full:

Office of the Scranton Stove Works,
Scranton, Pa., October 28, 1879.

B. F. Sturtevant, Esq., Boston, Mass.:

Dear Sir: I am forced to acknowledge our immense obligation to you for the Blower purchased upwards of ten years ago. It seems incredible, but no less a fact, that during all this time it has performed its work without the first dollar of expense. Its appearance is, to all intents, as when set up at first, and it shows no sign of weakening, although it is furnishing blast daily for about six tons of metal. Observing these things a few days ago, I have felt that this merited and unsolicited compliment is simply just to you. The blower is a No. 6, and has been in constant use. I honor you for giving the world so valuable a construction and invention.

Most truly, J. A. Price, Treas.

New Movable Jib Crane.

It is acknowledged that in the iron crane used at present in foundries and other establishments where very heavy weights have to be lifted, the movable carriage at the top of the jib is a necessity, in order to be able to vary the distance of the lift from the axis of the crane. This carriage, however, is subject to some objections, and in order to overcome them, Mr. Pratt, of the Pratt & Whitney Co., of Hartford, Conn., conceived the idea of making the whole jib movable, so that it could slide into the vertical column, and in this way vary the distance of the lift from the axis.

Fig. 1 represents this arrangement. The whole crane is built entirely of iron—the mast and brace of cast iron, and the jib of two pieces of rolled wrought-iron plate. The blocks and sheaves are also of iron, and the rope is of wire, cable laid. The projecting portion of the jib rests on a roll in the upper end of the brace, and its inner end on a similar roll in the hollow mast, and is made to traverse horizontally by means of a hand-wheel, worm and worm-wheel, and a pinion engaging with a rack cut in the under side of the sliding jib. This arrangement permits the jib to retract until it projects equally on either side of the mast, forming a T or cross, and occupying about one half the room it requires when fully extended. The upper end of the brace, not being fastened to the jib, is held in place by two rods, or bolts, extending from its upper end to the mast. The power for hoisting is transmitted by means of a crank, worm and worm-wheel. The worm and wheel are cut to such a pitch that a load will not run down by its own gravity, unless assisted by turning the hand-wheel. The maximum load for a No. 0 crane can be raised by one man, and No. 1 by two men. This machine is very useful in moving weights greater than one or two men can lift with facility, up to the full capacity of the crane, being handy in the foundry, the machine shop, the warehouse, on docks, and in other situations where a crane with permanently extended jib would be inconvenient.

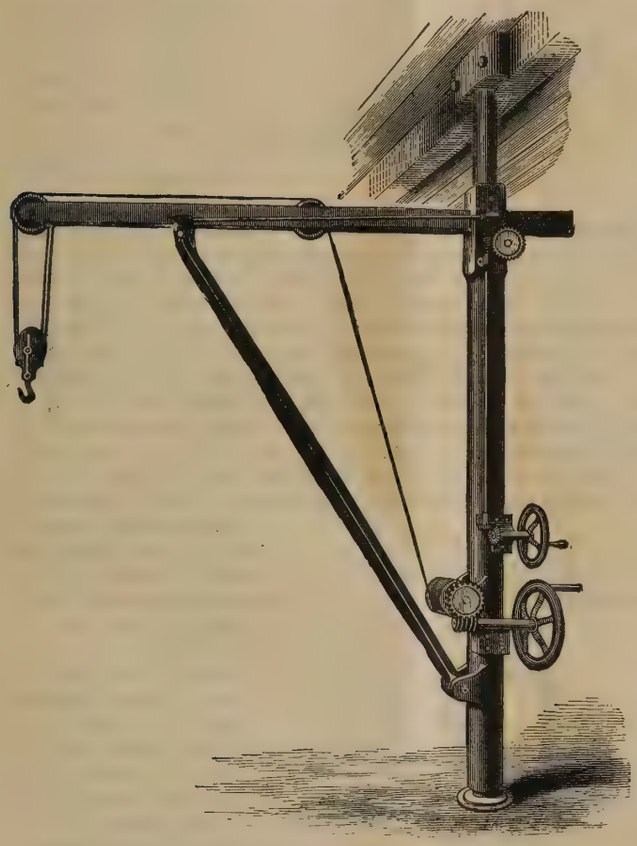


Fig. 1.—NEW MOVABLE JIB CRANE.

The hight of the column, or mast, is made as ordered, according to the hight between the floor and the ceiling. The nearest distance of the jib is 4½ or 5½ feet, according to size; this distance may be varied, according to requirements, up to 11 feet. The weight of the smaller kind is 1,500 pounds, with a lifting capacity of one ton; the larger kind weighs 3,000 pounds, with a lifting capacity of two tons.

Beleaguering the North Pole.

An international meteorological congress was recently held in Hamburg, when it was suggested how desirable it would be to extend the various stations for the International Weather Bureau as near as possible to the North Pole, while such stations could at the same time serve as bases for Arctic exploring expeditions.

It was even suggested that thus an attempt could be made to approach the North Pole gradually by means of a series of stations which should narrow the circle around that much coveted spot. It is reported from Copenhagen that as Greenland belongs to Denmark, the government intends to ask a considerable vote toward defraying the expenses of a Danish Arctic expedition, so as not to be left too far behind by the Swedes.

It is to be hoped that the plan which for a long time has been urged by the New York *Herald*, and other influential journals, will at last be realized, namely, that several vessels be prepared adapted for the service; that supplies of every conceivable kind be gathered together for not a mere single hibernation in some ice-locked bay, but for a protracted siege of years in duration; that a sufficient number of men be enlisted for the undertaking, with unstinted bounties, and that a trusty leader be found to command the forlorn hope which is always to precede the main body and mark out its pathway. It is proposed that this advance guard should proceed on ships as far north as practicable, and then a permanent camp should be established amid perpetual ice. At intervals from this camp to the open Atlantic other camps are to be made on shore, if it is posssible, and if not, vessels of supply are to be stationed and a constant communication kept up between the innermost explorers and the outer world. The foremost camp should, as rapidly as possible, be made a grand depot of men and supplies, and employed as the base for northward advances. From its shelter there should be a continual pushing forward and the establishment of a cordon of depots as far north as should be indispensable to the support and safety of the vanguard, who are to be always on the move ahead, and whose ranks are to be supplied right along with fresh men to replace the broken down and sick.

Compressed Air Locomotives in New York City.

The Third avenue horse railroad has now in operation one small locomotive, which is used instead of a span of horses to propel one of their ordinary cars. The machinery is partially on the front platform and partially below the bottom of the car and under the side seats, which will accommodate about half the number of passengers that the car will hold. The propelling power is compressed air, which is stored up at the depot up-town by a stationary engine, and tapped by the car from its reservoir at every trip, the capacity of the reservoir in the car being sufficient to contain compressed air enough for a down and up trip.

It appears to give satisfaction so far, and if this continues, it will afford great relief to the horses, which, when used on street cars, suffer much from the continual stopping and starting connected with this mode of travel. The Society for the Prevention of Cruelty to Animals will, we hope, encourage this new enterprise.

Improved Blacksmith's Drill.

The adjoined engraving (Fig. 2) represents an improved self-feeding drill, intended especially for the use of blacksmiths. It is, however, of course adapted for various kinds of drilling, and will drill from ⅛ to ¾ inch holes in cast or wrought iron. The frame is of iron, cast in one piece, giving the machine strength and stiffness. The forked arm, accurately machined, holds the finished table upon the lower spindle at any elevation within its limit of adjustment of 6 to 12 inches from the bottom of the main spindle.

The feed, having a run of 4 inches, has three rates of speed, which may be quickly adjusted by a thumb-screw. The gears, ratchet, and feed cam are cut; the cam roll, pawl and screws are hardened, and the construction throughout is excellent. The crank being rectangular, will not turn in the socket when the thumb-screw is loosened for adjustment. All bearings of the main spindle may be lubricated through an oil-hole in its top. Drilling may be done on wheels and other bulky articles by removing the table, or swinging it aside, and resting the work upon the arm or an independent support.

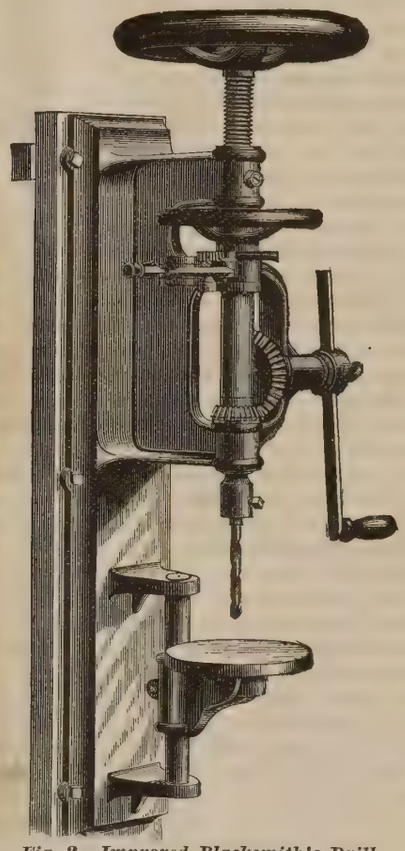


Fig. 2.—Improved Blacksmith's Drill.

This machine may be fitted for power by adding a cone pulley, which will not interfere with the hand crank. Its weight is 120 pounds, and is manufactured by the Pratt & Whitney Co., of Hartford, Conn.

Still More Petroleum.—The yield of the petroleum wells in Pennsylvania is so abundant at present that it is impossible to take care of all the oil that the wells produce. The great United Pipe Line is utterly deficient to convey all the oil to market, All the company storage tanks (each holding 5,000,000 barrels) are full to overflowing, as are also the tanks of private concerns, and every day 300,000 gallons are running to waste. So it appears that if we have artificial oil lakes above ground, the natural reservoirs underground are equivalent to oil oceans.

A Rotary Boiler Finally Bursts.

On page 15 of our volume for 1878, we published a demonstration to show that a rotary boiler cannot burst. The reasons given were that it is equally strong all around, and is equally exposed to the fire at all parts, so that there can be no weak spot produced by unequal exposure. As now in any steam boiler that bursts only the weak spot gives out, when there is no weak spot of course nothing can give out, *ergo*, such a boiler is non-explosive. So much for pure theory; now for practice.

On the 2d of last August, the town of Turner's Falls, Mass., was astonished by the explosion of a rotary bleaching boiler, which took place, as the papers reported, with astonishing force, killing one man and demolishing a substantial brick mill. Fig. 1 is a vertical section of the surrounding locality, and Fig. 2 a horizontal plan of the same. In both these figures A is where the boiler was located, and A′ the place where it was found after the explosion. The steam generators B B, Fig. 2, were outside, while the steam was conveyed to the rotary boiler by a pipe S S S; F was a water tank; H H H were rag-beating engines; and C was a machine of about 3 tons weight. The rotary boiler blew its right-hand head off, and was, with some of its contents, blown to the left, across the building, as indicated by the dotted line, throwing the machine C into the river, as seen in both cuts, while the boiler landed upon an embankment outside.

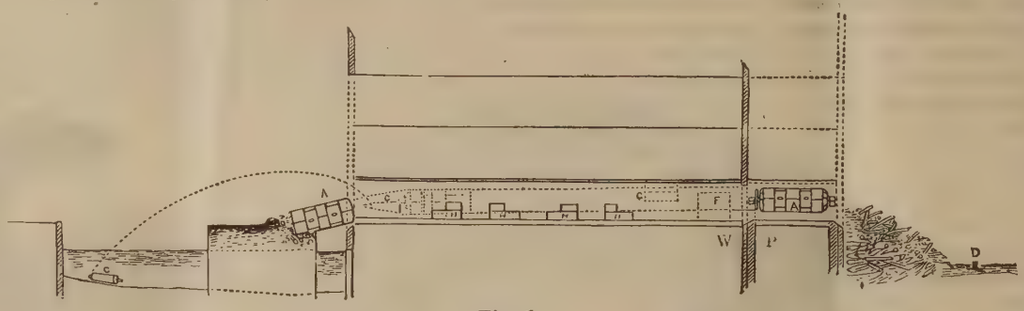


Fig. 1.

When we consider that the weight was 13,000 pounds and the contents 5,000 pounds of paper stock, with 14,000 pounds of bleaching liquor, we can form an idea of the force acting upon some 16 tons. The pressure on the boiler was about 50 pounds, and we ought to add that the boiler was 20 feet long and 7 feet in diameter, made of ½-inch boiler plate, double riveted. Fig. 3 represents the head which was blown off, and E E E, Fig. 2, the pieces of gore sheets blown from the head, which appears to have been the weak spot, as it was not double riveted, and, as a head, was subjected to more unequal strain than the cylindrical part, which remained uninjured. Fig. 4 represents a half section of the flange and wrought iron gore constituting the head, while Fig. 5 represents the center of the head, showing the lines of rupture of the gores.

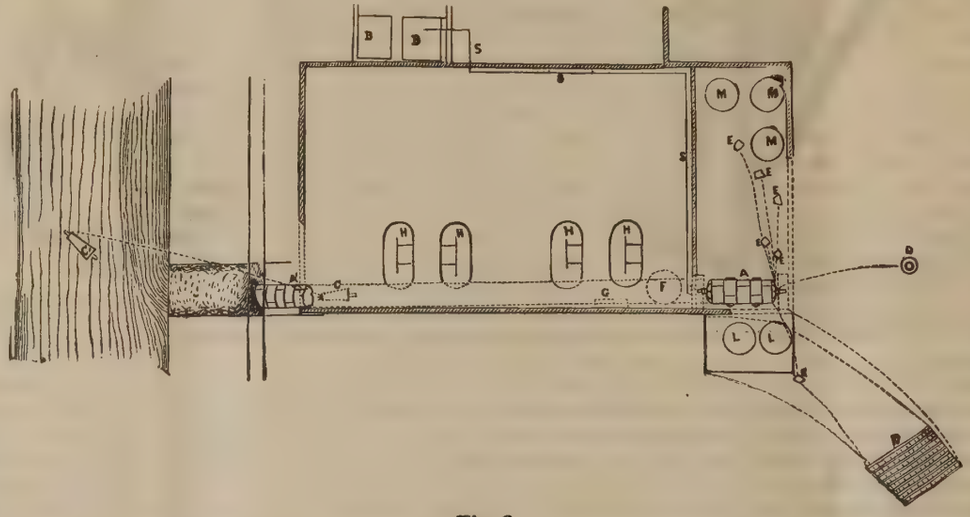


Fig. 2.

The study of the result gives us an insight of the tremendous force with which this rupture took place. The shell of the boiler, with one head, weighing about 6 tons, first met the 10-foot tank F full of water, then another suspended lime tank G, then the machine C, and lastly a 16-inch brick wall W, and went through all this for a distance of some 100 feet, without perceptibly deviating from a straight line. It reminds us of the artillery system of the late Dr. Vergness, who fired the guns themselves upon the enemy by slipping them upon a heavy cast-iron ramrod, firmly attached to the carriage. In the same way here, the boiler, instead of throwing its head to a great distance, went off itself as if shot away, and caused damage in proportion to its large mass.

It is evident that we have here an explosion caused by a moderate pressure upon a vessel that was gradually deteriorating by the chemical action of its contents, which at last rendered the iron so weak that it became unable to withstand the ordinary pressure.

That this ordinary pressure became capable of the results described, is easily understood when we consider that a 7-foot head contains about 5,400 square inches, which, at 50 pounds per inch, constitute a pressure of 271,300 pounds, or 135 tons, which suddenly let loose upon a mass of some 5 tons, must necessarily produce a result that will only astonish at first sight, but which, on careful reflection, must act according to what might have been expected under the circumstances.

We are indebted for our illustrations to the Hartford Steam Boiler Inspection and Insurance Co.

Railway through the Desert of Sahara.—The French Maritime Society has devoted one of its meetings to a discussion of the projected Sahara Railway. M. Soleillet stated that a canal between the Niger and the Senegal would be a more feasible undertaking than a railway. This would necessitate the removal of the bar at the mouth of the Niger. M. MacCarthy considered that the projected railway would be of great utility to the population of the Soudan, as it would reduce the journey from five months to two days. M. MacCarthy likewise said that the estimate of the Sahara population was greatly exaggerated. Tamassinine, which was represented as a town contained only a single house, and the tribe of Tonaregs, who occupied 200,000,000 hectares of the Sahara, did not number 200,000 souls. M. MacCarthy described the Sahara as a stony plateau, intersected with downs of sand.

Dangers Connected with Centrifugal Machines.

As not less than 88 accidents have happened in Germany with the 2,440 centrifugal machines used for the manufacture of beet-root sugar, it has induced an official investigation in regard to the causes. The results obtained from 285 refineries are as follows; 47 accidents were caused by carelessness on the part of the persons using them, resulting in injuries to the persons but not to the apparatus. Of these 13 were killed, 6 lost arms or legs, and 28 were seriously injured. There were 41 machines destroyed by being overloaded or mismanaged; of these 16 killed the operators, 2 produced severe injuries, 10 resulted in no personal injury, while 14 produced wounds without lasting injury. It appears from this that far more accidents happen from carelessness in handling than on account of the centrifugal form itself.

The Care of Steam Boilers.

The care and anxiety which every boiler owner ought to feel in regard to it, depends a great deal upon the confidence he can place in his engineer, as any anxiety respecting its quality is easily disposed of by the Hartford Steam Boiler Inspection and Insurance Company. It is indeed a consolation to boiler owners, that when they have bought their boilers from responsible manufacturers who use nothing but good material and give the best workmanship, and then have their boilers regularly inspected from time to time, they can put all anxiety from their minds, provided they have a reliable engineer. Statistics show that only one boiler in 7,000 of those subjected to such inspection, explode per year, while invariably these explosions are due to mismanagement, such as inattention to water gauges and to deposits from hard water, neglecting to close the blow-off cocks, keeping the feeding apparatus in order, blowing off all the steam before drawing the fires, neglecting leaks, and above all, incompetent, negligent, and even drunken engineers.

This matter has attracted so much attention in England, that the leading boiler insurance and steam power company in London has issued new instructions, which it is proposed to frame and expose in every boiler room in the United Kingdom under the control of the company. We hope that the same action will be taken in the United States. The new instructions read as follows:

"Water gauges should be blown out frequently during the day, and the glasses and passages to the gauges kept clean. More accidents are due to inattention to water gauges than to all other causes put together. Safety valves should be tried at least once a day, to make sure that they act freely. Overloading or neglect of these valves tends to the most disastrous results, and cannot be too carefully guarded against. Pressure gauges, where fitted with cocks, should be tried occasionally, by shutting off the steam and letting the pointer run back to zero. For this purpose the cock to the gauge should be arranged to open to the atmosphere when shut off from the boiler. Blow-off cocks should be taken apart, examined, and greased when the boiler is cleaned. Make certain that no water is escaping from the blow-off when the cock is supposed to be closed. Check valves, or self-feeding valves, should be taken out and examined when the boiler is cleaned. Satisfy yourself frequently that the valve is acting when the feed pump is at work. Fusible plugs

should be examined when the boiler is cleaned, and carefully scraped clean on both the water and fire sides. If this is not done the plug will not act. To save coal, keep the boiler clean inside and outside. If there is a plentiful supply of steam, keep a thick fire; but if short of steam, work with a thin fire, keeping the bars evenly covered. Firing a furnace on each side alternately tends to prevent smoke. To preserve the boiler, raise steam slowly. Never light fires until the water shows in the gauge glass. Never empty under pressure, but allow the boiler and brick-work to cool before running the water off. Clean the boiler inside regularly once a month—oftener if the water be bad. Clean all flues once a month, stop any leakages, and get rid of any damp in the seatings or covering. Examine especially plates subject to the direct action of the fire, the underside of the boiler, and any parts in contact with the brick-work, or with copper or brass, where water is present. If not required for some time, and it is impracticable to empty and thoroughly dry it, fill the boiler quite full with water, and put in a quantity of common washing soda. Should the water get too low draw the fire at once, as a rule; but if the fire is very heavy, or if the furnace crown appears to be red-hot, it is best to smother the fire with wet ashes, wet slack, or any earth that may be at hand. The dampers may then be closed. If the engine is running, or the feed pump delivering into the boiler, do not stop them; but if not working, do not start them, and do not attempt to blow off steam until the fire is out and the overheated plates have cooled."

Simple, concise, and straightforward directions, systematically arranged as these are, and touching upon nothing that is not of great practical importance to the boiler attendant, can hardly fail to command attention.

Another Great Tunnel.

The Italians are beginning to realize the enormous importance to them of an easy access by rail to the rest of Europe. The Alps forms a stupendous barrier at the north which separates the Italian peninsula, and is a fatal obstruction to the transportation of merchandize and a great impediment to travel in general.

While the experience with the railroad through the Mount Cenis tunnel, which connects Italy in a direct line with France, has proved the enormous advantages

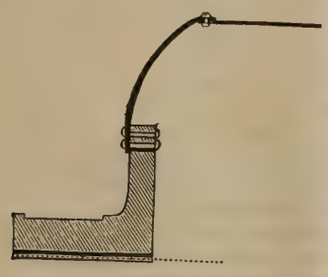


Fig. 4.

to be derived from their means of easy railroad transportation on an almost level track, and the completion of the St. Gothard tunnel, situated in Switzerland, is close at hand, which will form a connecting link with Germany, a third tunnel is contemplated and a provisional survey completed — namely, a tunnel under Mount Blanc, which lies entirely on Italian territory, and a railroad through which will also pass first on French soil, and then form a direct connecting link with the system of the Swiss railroads passing through Geneva, Lausanne, Neuchatel, etc., and by their intervention connect with the large net of Geneva and French railroads. Like the St. Gothard tunnel, which establishes an outlet to the country northeast of Piedmont, so the Mount Blanc tunnel will be an outlet for the countries northwest of Piedmont.

We expect that in future years the plan will be realized, to construct in the interior of the tunnel, about half way, a vertical shaft leading to the top of the mountain over it, and have an elevator in it to raise tourists to the elevations interesting to visit, without the labor of perilous ascensions over precipices, glaciers, and perpetual snow. A hotel, to be erected over the top of the tunnel, would then be of as easy access as any hotel along a railroad, and would afford the curious spectacle, that passengers leaving it, would go to the cellar, take seats in the elevator car, and descend a few thousand feet perpendicularly, as though going down a mine; finally they would reach the railroad

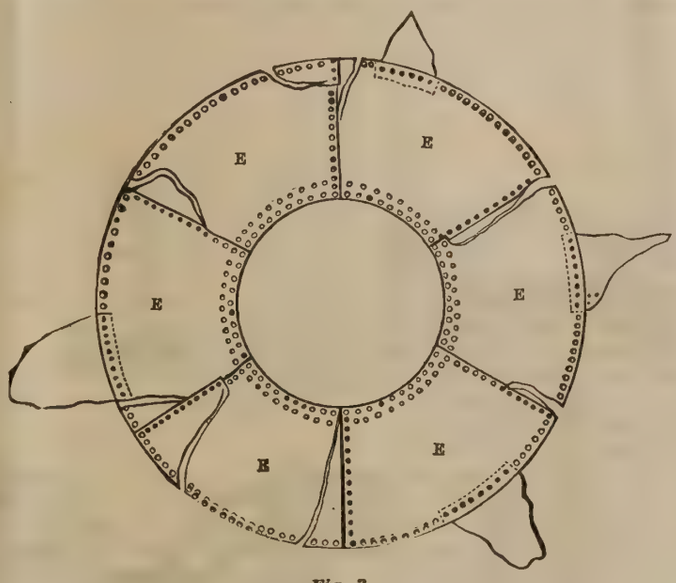


Fig. 3.

station in the interior of the mountain, where, embarking in a passing train, a very few miles of travel would bring them on the lower surface of the surrounding valleys or plains.

The ease which such an arrangement would afford to transport the building material for a hotel and afterward keep it supplied with provisions, would be of the greatest advantage. The lack of such facilities is one of the greatest drawbacks for the convent of St. Bernard, situated a short distance south of Mount Blanc; perhaps the tunnel could be projected to pass under the convent, when at once that world-renowned place of refuge for travellers would become of easy access, and travellers found lost in the snow could at once be sent down through the shaft, and from thence home by express trains. But this would take all the romance out of the great feats of travelling through dangerous mountain passes.

Lime and Hydraulic Cement.

From various authorities, among whom may be named, Vacat, Burns, Haswell and Gen. Gillmore, the following statement of the characteristics of various kinds and qualities of lime and cement has been compiled:

1st. The rich limes are the purest metallic oxid of calcium we possess, and the purer the carbonate of lime from which they are obtained, the more distinctly marked are the appearances from which they derive their name. These are that they augment in volume to twice their original bulk, or even more, when slaked in the usual manner, and that they will not set (harden) under water if not mixed with any other mineral material, even though left immersed for years.

2d. The poor limes are those which do not augment in bulk at all, or only to a trifling degree, when slaked. They do not set under water any more than the rich limes.

3d. The moderately hydraulic limes set under water in from fifteen to twenty days, but do not become very hard. The change of bulk they undergo in slaking is the same as that of the poor limes, but never equal to that of the richer varieties.

4th. The hydraulic limes set in from six to eight days' immersion, and continue to harden for some months.

5th. The eminently hydraulic limes set within three or four days, and become quite hard in a month.

A classification of rocks with reference to chemical examination is a follows:

1st. Pure calcareous rocks, or those containing from 1 to 6 per cent. of silex, alumina (common clay), magnesia, iron etc., either separately or in combination, give rich lime upon being calcined.

2d. The limestones having soluble silica in the state of sand, magnesia, the oxids of iron and of manganese, in various respective quantities, but limited to between 15 and 30 per cent of the whole mass, yield poor limes.

3d. The limestones containing silica in combination with alumina, magnesia and traces of the oxids of iron and manganese, in various respective proportions, but within the limits of from 8 to 10 per cent of the whole mass, yield moderately hydraulic limes.

4th. When the above ingredients are present in the proportions of from 15 to 18 per cent, but the silica in its soluble form always predominating, the limestones yield a hydraulic lime.

5th. When the limestones contain more than 20, and up to 30 per cent of the above ingredients, but with the soluble silica in the proportion of at least one-half of them, the limestones yield eminently hydraulic limes.

The experiments upon which the above conclusions are based appear to show that limes owe their hydraulicity, or power of setting under water, to the presence of a certain quantity of clay, and sometimes, but rarely, to the presence of a certain quantity of pure, soluble silica; and upon that principle a large proportion of our hydraulic cement, or water lime, is manufactured by mixing common fresh-burnt lime with burnt clay and grinding them together, generally in the proportions of 20 parts of clay to 30 parts of very rich lime, but the proportions vary with the qualities of limestones and clays found in different localities.

Science in the Streets.—Under the title of the "New Parisian Electric Pipe-Lights," a number of

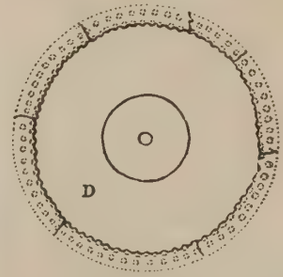


Fig. 5.

itinerant venders are selling in the streets of the metropolis small brass boxes containing three or four rodlets of metallic sodium, an inch long and one-tenth of an inch square. The method of using these lights, which are sold at a penny a box, is simple. A morsel of the metal is pinched off and placed on a piece of paper which has first been moistened with water or saliva. The sodium of course inflames and sets alight the paper. The risk to person and property that will be caused by the indiscriminate distribution of such a very dangerous material as metallic sodium, which even skilled chemists are obliged to handle with the greatest care, is obvious to all who know its properties. Attention has been called to the evil of allowing

the open sale of metallic sodium in toy shops under the name of "Satan's Tears," and we believe a stop was put to it by the police. In the present instance the danger is much greater, inasmuch as any urchin who has a penny to spare has it in his power to set half the buildings on a street in flames at a moment's notice.

Latest Telephone of Edison.

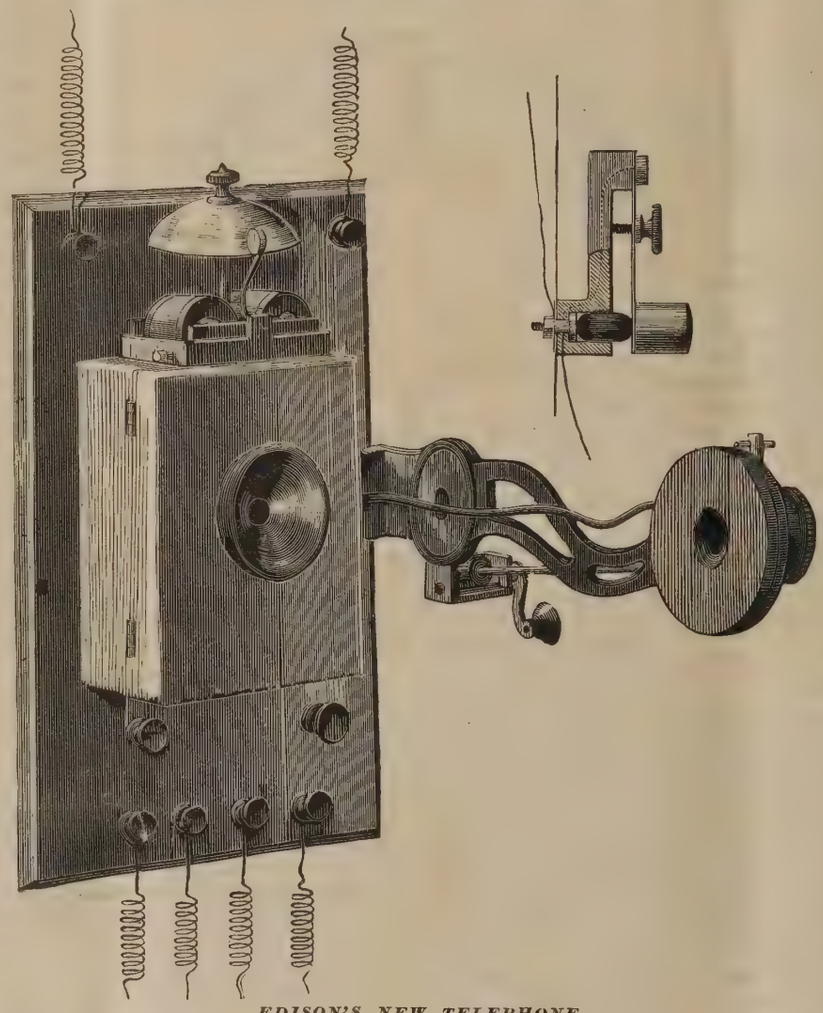
One of the most interesting experiments exhibited before the meeting of the American Association for the Advancement of Science, was that of Edison's latest improved electro-chemical telephone. It was attached to a stand in front of the platform, in the large room of the town hall, containing some 2,000 or 3,000 persons, and this telephone was found so unrivalled for loudness of speech that every person in the hall could hear what was said at the other end of the line, and transmitted to the telephone by an ordinary conducting wire. This is quite a feat, and an enormous step in advance of the Bell, Gray, or Phelps telephones, which require the observer to place his ear close against them, and even then the speech is not always distinctly heard.

The principle on which this telephone works is quite different from any of those mentioned, as the receiving instrument requires neither electric batteries nor magnets of steel or of coiled soft iron. The principle upon which it works is a variation of friction, which takes place when a conducting point is sliding over a surface, while an intermittent electric current runs from the point to the surface, or *vice versa*.

Edison discovered this principle a long time ago, and at first tried to produce by it the points and dots of the Morse alphabet, without using electro-magnetic attraction. He made a point which touched a revolving cylinder, and so adjusted that the friction of the revolving cylinder pulled it forward, overcoming the tension of a spring which held the point back; every time the current passed the friction between the cylinder and the point became very small—in other words, the current made the surface temporarily so smooth that the spring caused the point to slip back; when it slipped back a simple leverage produced a contact, making a point or a line, in proportion to the length of time the current lasted, while as soon as the current ceased the point was pulled forward again by the revolving cylinder. It should be understood that the whole extent of the motion of this point was only $\frac{1}{8}$ of an inch, or even less, which was quite sufficient to make the telegraphic dots and lines, a point being formed on the ordinary strip of travelling paper every time the current lasted only an instant, and a line in length in proportion to the time the current lasted.

In applying this idea to the telephone, Edison attached the point to the diaphragm, and when the cylinder is turned the friction is sufficient to pull the diaphragm forward; but when the slightest intermittent current is passed, the frictional surface of the cylinder is changed into a smooth surface in regard to the point, and the diaphragm pulls it back. It does this for every wave of the current, each of these therefore producing a single vibration of the diaphragm, and hundreds are required for every word. When no current passes, the point is pulled forward by the revolving cylinder, and the elastic diaphragm kept uniformly on the stretch; when currents pass, the diaphragm becomes able to pull the point backward as often as an electric wave passes, and this causes vibrations equivalent to the velocity and character of the waves.

Understanding the principle upon which to base such a telephone, the practical question was, What are the best materials for the cylinder and the point? After numerous experiments Edison found that precipitated chalk, solidified at great pressure, was the best material for the cylinder, and for the point a piece of platinum faced rubber. He also found that the chalk must be wet, and, after trying hundreds of solutions, he at last found that it was best to saturate the chalk with an alkali or its phosphate, and finally that the best solution of all was a diluted solution of hydrogen disodic phosphate.



EDISON'S NEW TELEPHONE.

In the adjoined engraving the receiving instrument is represented at the extreme right, and so hinged that it can be turned out of the way when not in use. It has a small crank (seen below) that is turned around when the reception of a message is expected; this crank is connected by an axis to the revolving chalk cylinder in the little receiving box seen at the extreme right; this box is also connected by the isolated conducting wires seen above the straight axle connected with the crank. The transmitter is the square box seen at the left, with its mouth-piece in front and the call-bell on top.

The details are represented in the small figure at the upper right-hand corner of our engraving. A vulcanite arm is secured to the center of the mica diaphragm by means of a small bolt, which is connected with one pole of the battery by a piece of metallic foil or very thin copper wire. The head of this bolt is platinum-faced, and sunk deeply in the vulcanite arm, the same cavity also containing a piece of carbon pencil, such as is used for electric candles. The carbon fits the cavity loosely, and is rounded at both ends; its outer end is pressed by a platinum-faced spring secured to the outer end of the vulcanite arm; the spring carries at its free end, exactly opposite the piece of carbon, a brass weight, and the pressure of the spring upon the carbon is regulated by the small set-screw. A wire or piece of copper foil, connecting with the spring, completes an electric circuit, which includes the primary of an induction coil contained by the rectangular box. The secondary wire of the induction coil is connected with the telephonic line, and a tertiary coil which envelops the secondary is connected with the rubber and chalk cylinder of the receiving instrument. Below the transmitter box are two keys, the right-hand one being used for signaling, and the left-hand one for completing the tertiary circuit when a message is received.

Another Murder by "Putting on Ice."

The city of Hartford, Conn., was recently thrown into a state of excitement by the premature burial of a young lady 18 years of age—Miss Mary Gregory—who had just finished her schooling in New Haven. Her education had been acquired with a view of becoming a teacher, but a short time before graduating she became engaged to be married. For several months she complained at times of severe pain in the head. Her illness was not regarded as serious at first, but when she became much worse a physician prescribed morphine to to alleviate the pain in the head. Mr. Gregory sat up with his daughter a part of the night, but finally went to bed, Mary saying that she could take her medicine, as needed, herself. Two tumblers, one containing the morphine and the other water, stood on a table at her bedside. The next morning she had a convulsion, and relapsed into unconsciousness; there were intervals of consciousness, but at last she fell into a comatose state, from which there was no arousing her. A physician was called in; he saw at a glance that the tumbler containing the morphine was empty, and that the patient had taken a fatal dose. A consultation was held, and the doctors pronounced her dead. There seemed to be no doubt that Miss Gregory had drank the morphine potion by mistake for water. An undertaker was called in, and he at once put the body on ice. It was noticed that the dead girl's face retained an unusually life-like expression—the face was slightly flushed, the eyes were bright, and the flesh was as elastic as that of a living person. The body remained on the ice twenty-four hours, and was then laid in its casket.

The neighbors who saw the remains could hardly be convinced that Mary was dead, so startlingly life-like were the features. Although the body was cold, the cheeks were flushed, and the ears and lips were of their natural color. The physicians had repeatedly asserted that life was extinct, and that the appearance of the corpse indicated no trace of a remaining spark of vitality. Reluctantly the parents consented that the coffin lid should be shut down, and on Monday (Miss Gregory died on the previous Friday) the funeral took place. At the grave the coffin lid was again lifted and a physician, who had gone to the grave at the parents' request, again examined the body, and said there was no sign of life, though the striking resemblance to life remained. The coffin was lowered to its place, and the earth shovelled upon it. The sight of the rapidly

filling grave was more than the grief-stricken parents could bear, and the father, with a frantic gesture, bade the men cease their work and raise the coffin. The coffin was taken to a house near by, and the lid removed. Sympathetic neighbors gathered to assist the parents in their hopeless efforts to restore life to the dead girl. Her limbs were chafed, hot applications were made, and every means suggested for resuscitation were tried without success. Previously a vein in the arm had been lanced, some one having said that if death had taken place no blood would flow; blood started from the wound made by the lance—not enough to give positive hope, but sufficient to leave the question of life or death unsettled. The body lay in the open coffin until the following day, when Dr. Rowell, of Stamford, made further tests. A powerful galvanic battery was applied, and, at the end of his experiments, Dr. Rowell said that he was convinced that Miss Gregory was dead. On Wednesday the final interment was made, the parents being convinced that further effort at resuscitation was useless.

Dr. Rowell said that the case was a remarkable one, but the striking semblance to life in persons dying of certain diseases was not unknown in medical science. "I think," said he, "that Miss Gregory was dead when she was so pronounced by the physicians. At any rate, she could not have lived after she was placed upon ice; the efforts to revive her afterward were useless, and were made only to satisfy the family."

The above report teaches some serious lessons:

First. How wrong it is to exhibit such an unnecessary, and, we might say, indecent haste to send for an undertaker as soon as a person dies, or is supposed to be dead. Why, we ask, should there be such a great hurry? Nothing certainly is lost by waiting. When the undertaker arrives, he at once begins his business, which is to put the body on ice, in case the relatives are able to pay for it. We know that this is one of the most profitable items for undertakers, and a friend informs us that on the death of a child, he refusing to have the body put upon ice, the fashionable undertaker refused to have anything to do with the burial, compelling him to employ a less fashionable undertaker, who was willing to take charge of it without making death sure by the use of ice.

Second. How wrong it is for a physician to pronounce a positive opinion that a person is dead in case he finds that circulation and respiration have ceased. He should know that there are numerous cases on record where life has been restored after the lapse of several hours, and even days, without any perceptible circulation or respiration.

Third. How wrong it is for relatives not only to make such indecent haste by sending for an undertaker, but, after having engaged one, let him have it all his own way and dispose of the job in the shortest time possible. It is of course to the undertaker's interest to dispose of the business as quickly as possible. It should be remembered that he is a business man, and, like every business man, wants to attend to business promptly. What does he care whether it is certain or not that the person is really dead; the sooner the burial is over the sooner he can send in his bill, not to speak of the risk he runs of being cheated out of his job by the person coming to life again. In the above described case the parents should have waited until the only sure sign of death (decomposition, or putrefaction) appeared. What would have been lost by keeping the dead body of a dear child above earth until that time, even if it was for a month? Are people still so barbarous that death changes their love for dear relatives into such aborrence that they want to put them out of the way as quickly as possible, never allowing more than a few days to pass, and never a week?

Fourth. If nephews and nieces have a rich, old uncle or an aunt, and are desirous of enjoying the benefits of an expected inheritance, without vexatious postponements, the best thing they can do is to send for an undertaker as soon as the uncle or aunt has a fainting fit, with stoppage of the pulse; if the undertaker then puts the body upon ice without any unnecessary delay, the heirs will be sure of an uninterrupted burial and an early division of the spoils.

Electrometers.

We represent here two modern electrometers, as they are to be found at the Stevens Institute, Hoboken, N. J., and also in other institutions that keep up to the modern requirements of practical science.

These instruments may be divided into two classes, those intended for static electricity, and acting by the mutual repulsion of two equally charged substances; and those intended for dynamic electricity, and based on the property of magnets to place themselves at right angles to the currents passing through properly arranged conducting wires or coils of wire.

The old electrometers of the first class consist of two cork balls suspended by threads, or two strips of gold

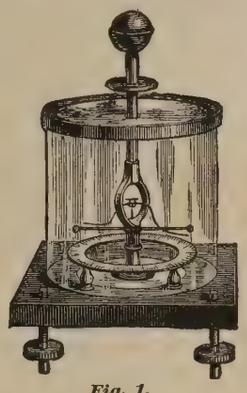


Fig. 1.

leaf suspended parallel; the electric charge will cause them to repel one another, and in this way the presence of electricity is ascertained. Fig. 1 represents a more elaborate instrument of this kind; it is the invention of Peltier, and is named after him. It consists of a support carrying a glass cylinder to shut off all air currents. In the cylinder is a curved balanced aluminum rod, turning on a pivot, and having a small compass needle attached to it, so as to give it a decided direction. On top of the glass case is a brass ball, standing on a rod, which goes through the glass case

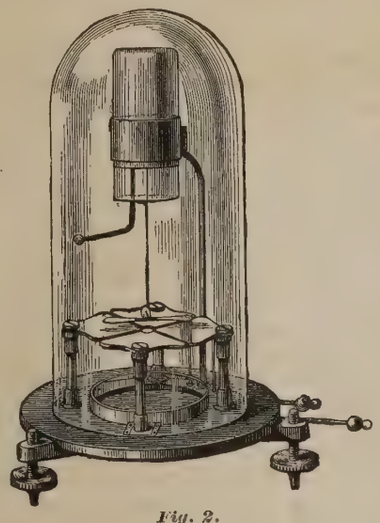


Fig. 2.

and communicates below with a horizontal brass rod, having small balls at its extremities; but there is no contact with the aluminum rod, except when desired, by turning the brass ball on the top, which turns the interior brass rod so that it can be brought in contact with the aluminum rod at opposite sides. When a charge is communicated to the brass part, the aluminum rod will be deviated and the amount of deviation on a scale, and in this way the tension of the charge measured.

Fig. 2 is Thomson's quadrant electrometer; it consists of four metallic segments, supported in the same plane, but not in contact. They are connected alternately with the two projecting rods and balls at the right; over these hangs a strip of aluminum by a fine wire, from the inside of a Leyden jar feebly charged, (seen at the top). If now one pair of the sectors are charged, while the other are connected with the earth, the strip of aluminum will move towards them if the charge is opposite to that of the aluminum rod and the jar; but if the charge is of the same kind, repulsion will take place and the aluminum strip will move away from them and over the other segments that are not charged. In order to give a directive force to the aluminum strip a small compass needle is attached to it, as is the case in the electrometer of Peltier, described in Fig. 1. In order to observe and measure slight motions of the aluminum strip in Fig. 2, a small mirror *a* is attached to it, and a ray of light reflected by it upon a scale placed against the wall; the least turning of the mirror will cause this ray of light to travel sideward—in fact, it will act like a very long hand on a dial against the wall.

It is evident that such delicate instruments should always be placed under glass shades, in order to prevent disturbances by air currents, such as those generated by breathing near them. In this case the Leyden jar should also be under the glass shade, so as to keep it charged longer; it is charged by the curved rod seen under it, which is connected with its inside covering, while the outside covering is connected exteriorly with the earth, when it is charged, but after being charged the connection may be severed. The two knobs seen at the right side below serve to charge the segments.

Drug-Taking Mania.

BY DR. FRANK HAMILTON.

Women are rather more given to drug-taking than men, though both are bad enough in this respect. Here is what one of our most eminent physicians has to say on this subject:

"Dr. Holmes has said that it would be well for the world if most medicines were thrown into the sea; that it might be bad for the fishes, but it would be better for mankind. For this unasked and impertinent suggestion he has received a good deal of orthodox censure, which I am here now to share with him, for I am of the same opinion as Dr. Holmes, and this opinion has long been a part of my Christian faith. That the major part of the world does not agee with us is plain. Babies take it in their mother's milk; children cry for it; men and women unceasingly ask for it. Shrewd men have taken advantage of this instinct, and in most civilized nations it is to-day one of the chief articles of manufacture and commerce. It is one of those things which is never permitted to be out of sight; but is thrust upon you in the nursery, in the streets, upon the lamp post and upon the curbstones, along the highways, from the rocks which border the rivers; the medicine chest follows you at sea, as if the sea itself, a vast gallipot of nauseants, were not enough. One might naturally suppose that the supply would at length exceed the demand! but it does not. Everywhere the people are stretching out their arms and begging for medicine, blessing him who gives and cursing him who withholds. They believe, in their simplicity, that if medicines do no good they can at least do no harm. They imagine, also, that there are medicines which may be regarded as a specific for every human malady, and that these are known to science, and that therefore we have the means for curing all diseases; but the people imagine a vain thing. Whatever medicine is capable when properly administered, of doing good, the same medicine is equally capable, when improperly administered, of doing harm; and drugs often substitute a malady more serious than that which they intended to cure. The Irishman said his physician so stuffed him with medicine that he was sick a long time after he got well."

Self-Regulating Pumping Engine.—A self-regulating pumping engine is now in operation at the Providence (R. I.) water works. It has 10 cylinders, five for water

and five for steam, arranged alternately in a circle. It possesses an enormous capacity, but it will, without attention from the attendant, do the duty of pumping either for a single faucet or for a dozen steam fire engines. The cylinders are all connected to a central upright shaft, which automatically either makes one revolution in five minutes or 25 in one minute, according to the water required. If the fire burns low, the engine will open the damper; if this is not sufficient, it will put on the blower.

Scientific.

Norwegium a New Element.—The chemist nowadays has to record a new element almost as often as the astronomer records a new asteroid. Tellef Dahl, inspector of the Norwegian mines, has found a new metal in the arsenite of nickel and nickel glandz of Ottero, in Norway, and has called it Norwegium, after the country in which it was first found.

It is a white metal, somewhat malleable, of the same hardness as copper, and melting at a red heat. Its density is nearly that of silver, being 9.5, while, like silver, it dissolves easily in nitric acid, but not so well in hydrochloric acid. The solution, however, is blue, and becomes green when diluted with water. Unlike silver, it dissolves in sulphuric acid. Its chemical equivalent has been found to be 146, and its formula will be Ng. Its soluble salts are precipitated by caustic potash, ammonia and carbonate of soda. The green precipitate is soluble in most acids, and gives blue solutions. Sulphuretted hydrogen produces, in most of the solutions, a brown precipitate of sulphuret of Norwegium, insoluble in the sulphuret of ammonium. In the blow-pipe oxidation flame it gives, with borax, a yellow-green, which becomes blue on cooling. The blue is more decided in the reduction flame. The microcosmic salt gives a yellow-green, emerald green when cooling, then violet and blue. The metal is easily reduced on charcoal with carbonate of soda.

The way in which the metal is obtained from the ore, is to roast it first, so as to eliminate the arsenic. The roasted product is dissolved in aqua regia and precipitated with sulphuretted hydrogen, the precipitate washed, and again roasted, so as to remove the sulphur and all traces of arsenic. The product will then be the impure oxid of Norwegium; this is then dissolved in aqua regia and precipitated with the necessary quantity of caustic potassa. Care must be taken not to add an excess, as this would re-dissolve the precipitate. The precipitate does not contain all the metal, as part of it remains in solution as a peroxid. The hydrated oxid thus obtained is of the color of emerald green, and is easily reduced to the metallic state by heating in a crucible with charcoal, or by a current of hydrogen gas.

Using the Spectroscope for Determining High Temperatures.—The employment of the spectroscope in the comparative measurement of high temperatures has been described by M. Crova, of Montpellier, France, before the Academy of Sciences. According to his description, the process is, roughly speaking, to adopt a fixed standard, and, having settled that point, to examine by aid of the spectroscope the flames of incandescent objects, and reduce them by interposing obstructives of known power to the same level as the standard. That arrangement he calls a Spectrophotometer. Of course, in such an apparatus the primary data must be purely arbitrary.

Professor Crova adopts as his standard the heat emitted by an ordinary moderator lamp burning oil, which he fixes at 1,000° Centigrade. In making his comparisons, he finds the heat of a piece of platinum heated to redness to be 524°; the same at white heat, 810°; a regulation stearin candle, 1,162°; an Argand burner of common coal gas, 1,373°; lime light, oxygen, and coal gas on lime, 1,806°; the electric light, 60 Bunsen elements, 3,060; and the light of the sun, 4,049°.

In order to reduce these Centigrade degrees to Fahrenheit, multiply them by 9, divide by 5, and add 32°.

Carbon, lime and platinum, when incandescent, have the same power, and probably magnesium. This new system is calculated to be of vast importance to manufacturers, by enabling the operator to regulate his fires so as to produce the precise effect desired. M. Dumas, in bringing the matter under the notice of the Academy of Sciences, stated that he considered it the greatest discovery of modern times, and M. Berthelot warmly supported his statement.

Antiquity of the Earth.—T. Mellard Reade, in his book on "Chemical Denudation in Relation to Geological Time," says: "The phenomena of sub-aerial denudation now holds an important place in geological theory, and the changes of contour and surface which were formerly attributed to subaqueous influences have come to be chiefly ascribed to the action of glaciers and torrents. In the main, there is no doubt these second thoughts of geologists are the most accurate; but the action they have in view is mostly mechanical, and the chemical action of acids held in solution by the rain or in the atmosphere has not been so much taken into account. In fact, although the amount of mechanical denudation by rain has been carefully estimated, and computations of time founded upon it, no attempt has, up to the present time, been made to estimate the soluble constituents annually removed from the earth's crust."

This the author of the present treatise essays. Without following him through his calculations, a few of the results may be stated. He considers there is ground for the provisional assumption that the effect of soluble denudation by rain in England is to lower the surface about a foot in 13,000 years. Then, as to the bearings of these changes on the question of geological time, he shows that, by even a much lower estimate of the rate of denudation, it would take 25,000,000 years to accumulate the quantity of sulphate of lime and magnesia contained in sea water, and 200,000,000 years to renew its chlorids; and on these and other grounds that the sedimentary crust of the earth, taken on an average at 10 miles thickness throughout, must have taken, in laying down, on a very moderate estimate, 600,000,000 years—a period, by the way, amply sufficient for all the changes of the evolutionists.

Those Dangerous Scientists.—The New York *Herald*, in its usual sardonic style, makes the following remarks in regard to the dangers to which science exposes the modern condition of this world in a religious as well as in a secular aspect. We reprint it for the sake of a few well deserved hits. Says the *Herald:*

"Modern science has its advantages and its disadvantages. It is all very well to tell the sun that he needn't trouble himself to rise any more, because we can light up the world with electricity; but when it comes to the use of the telephone in such a way that the Christian ministry is in danger of abolition, the matter becomes serious. In Lowell the telephone is attached to a certain pulpit and then carried into the houses of the parishioners, who sit in their easy chairs or puff away at the friendly cigar, while the voice of the preacher resounds through the room. If this thing is carried much further Othello's occupation's gone. Dr. Storrs can be hired to preach to the entire continent. Sitting in his study, he can deliver a discourse to a large bundle of wires connecting with every house this side of the Rocky Mountains, and the rest of the ministers will have to engage in some honest but respectable employment. However, there would be a compensation for even that misfortune, for Dr. Talmage would have no use for the clerical trapeze, and even Dr. Fulton would be compelled to be civil. These two advantages would make the world seem brighter, and we are almost inclined to hope that Mr. Edison may complete his invention."

Measuring Distances to Remote Objects.—Mr. John Boger, of Powhattan Point, Ohio, has recently patented an improved instrument for measuring the distance of remote objects. It is described as being based upon the general principle of the employment of two right angular bars, one of which is provided with a sighting glass, directed toward the object, and the other graduated and provided with another instrument, which, when adjusted to a certain position upon the bar and turned to the object, indicates by the angle at such position the distances which the different angles and positions together indicated, being previously determined by careful measurement.

We fail to see anything new in this instrument. Contrivances with sighting glasses at one or both ends of a base line, for the purpose of measuring the distance of inaccessible objects, have been invented over and over again. The only novelty may perhaps be some trifling additions, not essential to the principle applied, and on which the patent claim may be based. This is a very common trick employed to obtain a patent for an old device.

Artificial Precious Stones.—Two French chemists, MM. E. Fremy and Feil, have discovered a method of making, in large quantities, precious stones which rank in value next to diamonds. Such an announcement would naturally have the effect of exciting dealers in precious stones, since this method must enable a large quantity to be thrown upon the market; and as their value depends, not upon intrinsic worth, but upon the law of supply and demand, it must necessarily decrease the value of this class of goods.

Be this as it may, the experiment has been tried with success, and as it is a matter of interest to our scientific inventors, we give the method by which they are produced. The principle is based upon that of separating the argillaceous clay slowly from its usual combination with silicic acid as it is found in nature everywhere, by bringing to bear upon it a substance of stronger affinity for the acid. By this means small crystals of argillaceous earth are formed in the fiery liquid, and which, in the course of further separation, grow slowly. Quantities of this fiery "mother liquor," as it is called, weighing from 30 to 50 pounds, were kept in a fiery liquid state in M. Feil's glass factories for two or three weeks, and the experimenters were therefore enabled to test the matter thoroughly and conclusively. Oxid of lead was used to separate the argillaceous earth from the silicic acid, and to accomplish this a mixture of equal parts of pure porcelain clay and red lead was made and placed in a fire-proof clay crucible, and exposed for weeks to an intense heat. It was then taken out and allowed to cool. When the crucible was destroyed, they found two strata above a glassy one; the glassy structure contained the most beautiful clusters of round crystals, which were found hard enough to cut rock crystal, or even the very hardest topaz.

Microscopic Test Plates.—It is reported that Mr. G. Fasoldt, an optician of Albany, N. Y., has announced to the scientific world that he was able to manufacture a microscopic slide, called "micrometric rulings," in which, by the aid of a diamond, he has cut 120,000 clearly defined lines to the inch.

This has already been done by Nobert, and his glass plates, with rulings of 20,000, 60,000, 80,000, 100,000, and 120,000 lines to the inch, are well known to microscopists. The latter divisions seemed an impossibility, and microscopists often obtained specimens mainly for the purpose of proving the falsity of the statement. Several were able to see 45,000 lines, the rest being invisible to them; some of them said they saw 90,000 of the lines, but envious persons declared they imagined all above 45,000. It was finally discovered that, by proper oblique illumination, the 120,000 lines could be seen by the aid of a Spencer one-6th objective. These test plates are one of the greatest wonders of the age, and one which will enable the faithful students and workers in microscopy to accomplish still greater victories in their department of science, as they constitute the best test for the power of a microscope.

Novel Style of Ornamenting Iron Surfaces.—The invention of Dr. Weil, of Paris, for coating iron and steel with copper or nickel in such a manner that the surface shall be iridescent, opens a large field for the employment of metal for decorative purposes. The best mode of preparing the metallizing bath, and the best proportions of ingredients, are indicated in the following directions: First, 35 parts of crystallized sulphate, or an equivalent amount of any other salt of copper, are precipitated as hydrated oxid by means of caustic soda or some other suitable alkaline base; this oxid of copper is to be added to a solution of 150 parts of Rochelle salts, and dissolved in 1,000 parts of water; to this 60 parts of best caustic soda, containing about 70 per cent NaO, is to be added, when a clear solution of copper will be formed. All colors, from that of brass to bronze, scarlet, blue and green may be produced at will. A dynamo-electric machine may of course be substituted for the battery. The ornamental iron castings made in both Great Britain and France are really beautiful in form and design, and by the judicious coloration of them with combinations of iridescent brass and scarlet, brass and blue, or brass and green, would produce effects which would insure their general adoption.

Velocity of Light.—The thirteenth volume of the "Annales de l'Observatoire de Paris" contains the memoir of M. Cornu on the determination of the velocity of light, embracing a complete recital of the experiments made between the observatory of Paris and the tower of Montlhery. Everything was done to obtain the greatest possible precision, by perfecting the method of the toothed wheel, which was devised by Fizeau in 1849. The method of observation, the construction of the various articles of apparatus, and their mode of acting, have been discussed in their most minute details, with a view to ascertain the causes of error, and to determine the most favorable conditions for their elimination. The agreement of results obtained under the most varied circumstances shows the great importance of this discussion. Care was taken in all cases to prove that the deviations followed the law of accidental errors, a verification commonly neglected, but without which the calculus of probabilities cannot be legitimately applied. The result of the experiments gives, for the velocity of light, 300,400 kilometers per second.

The members of the American Association for the Advancement of Science, were, at their last meeting, highly entertained by the details of the refined experiments made with improved apparatus at the Naval Academy, Annapolis. The results were the mean between those of Foucault and Cornu. The first found 185,200 miles, the latter 186,670, and the Annapolis experiments 186,305 miles.

Running a Locomotive with Compressed Air.—An amusing incident in the career of Mr. A. L. Holley is related by a New York paper. While working as an engineer on one of the railways, he made a wager with some of his fellows that he could run a locomotive a mile without fire, water or steam, the locomotive to be taken empty and cold from the shop and towed by another engine to a point at some distance on the road, where a level stretch of track favored the experiment. Young Holley rode in solitary state on his cold locomotive to the scene of trial, and, unsuspected by his escort, set his locomotive for backward running, so that the revolution of the driving wheels moved the pistons in such a way as to pump air into the boiler. This gave him, by the time the destined point was reached, more than 150 pounds of air pressure in the boiler, by means of which he ran his mile and won his wager.

Origin of Petroleum.—One of the latest hypotheses of the origin of petroleum is that advanced by M. Mendelejeff. Starting with the nebular hypothesis, he regards the interior of the earth as metallic, doubtless composed largely of iron and carbides of iron; through rents made by earthquakes, water gained access to these bodies at a high temperature and under great pressure, and, by their mutual chemical action, metallic oxids and saturated hydro-carbons resulted. It is these latter, according to M. Mendelejeff, that carried by watery vapor, have made their way through the over-lying rocks.

The Atmospheric Carbon-Dioxid.

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"The only known source of carbonic-dioxid, apart from combustion and respiration, are certain terrestrial exhalations of the gas, probably due to chemical reactions liberating small portions which had long before been fixed in the form of carbonates. We are thus forced to one of two conclusions: Either the wholly improbable one that the atmosphere, since the appearance of organic life on the earth, has been one of nearly pure carbonic-dioxid, and of such immense extent that the pressure at the surface would have sufficed, at ordinary temperatures, for its liquefaction; or else, the atmosphere being so constituted as to permit vital processes, that carbonic-dioxid, as fast as removed by chemical action at the earth's surface, was supplied from some extra-terrestrial source. We may, in accordance with this last hypothesis, admit that the atmosphere is not terrestrial but cosmical, and that the air, together with the water surrounding our globe, (whether in a liquid or a vaporous state), belongs to a common elastic medium, which, extending throughout the interstellary spaces, is condensed around attracting bodies in amounts proportional to their mass and temperature, while in the regions most distant from these centers of attraction, this universal atmosphere would exist in the state of greatest tenuity. Such being the case, a change in the atmosphere of any globe, whether by the absorption or disengagement of any gas or vapor, would, by the laws of diffusion and of static equilibrium, be felt everywhere throughout the universe; and the fixation of carbonic-dioxid at the surface of our planet would not only bring in a supply of this gas from the worlds beyond, but, by reducing the total amount of it in the universal atmosphere, would diminish the atmospheric pressure at the surface of our own and of other worlds.

"This hypothesis is not altogether new. Sir William R. Grove, in 1842, put forth the notion that the medium of heat and light may be "a universally diffused matter," and subsequently, in 1843, in his celebrated essay on the "Correlation of Physical Forces," in the chapter on Light, concludes, with regard to the atmosphere of the sun and the planets, that there is no reason why these atmospheres "should not be, with reference to each other, in a state of equilibrium. Ether, which term we may apply to the highly attenuated matter existing in the interplanetary spaces, being an expansion of some or all of these atmospheres, or of the more volatile portions of them, would thus furnish matter for the transmission of the modes of motion which we call light, heat, etc., and possibly minute portions of these atmospheres may, by gradual accretions and subtractions, pass from planet to planet, forming a link of material communication between the distant monads of the universe." Subsequently, in his address as president of the British Association for the Advancement of Science, in 1866, Grove further suggested that this diffused matter might be a source of solar heat, inasmuch as the sun may "condense gaseous matter as it travels in space, and so heat may be produced."

"In 1870, Mr. W. Mattieu Williams, who does not seem to have been acquainted with these views, published his ingenious work, entitled "The Fuel of the Sun," which is little more than a development of the suggestions of Grove. The source of solar heat, according to him, is the condensation by the sun of the attenuated matter or ether everywhere encountered by that body in its motion through interstellary space. The heat which, from sun and planets, is radiated into space, is thus first absorbed by the ether, and then again concentrated and redistributed by the sun.

"Dr. P. Martin Duncan, in his address as President of the Geological Society of London, in May, 1877, without noticing the priority of Grove, has adopted from Williams the notion of a cosmical atmosphere, but supposes that the sun, by virtue of its greater mass, is slowly attracting to itself the greater part of the earth's atmospheric envelop. From this view he proceeds to deduce important geological considerations, conceiving that, from the greater hight of the terrestrial atmosphere, which, according to his hypothesis, must have prevailed in former ages, there would have resulted a higher temperature at the earth's surface, more aqueous vapor, a more equable climate, and a prolonged twilight at the poles. From a more abundant precipitation greater sub-aerial denudation would follow, and although local glaciation of high mountains might occur, the existence of masses of ice at the earth's surface, or for some thousands of feet above it, would be impossible.

"If, however, the principles which have been already advanced are correct, it is not to solar attraction that we are to attribute a progressive diminution in the hight of the atmospheric column, but to the various processes going on in the worlds, whereby the atmospheric elements are condensed in the form of liquid water or fixed as hydrates, oxids, or carbonates. The operation of such processes in our own and other planets in past ages must have produced a considerable refrigeration of climate by reducing the weight of the atmosphere, and a still more marked result of the same kind by diminishing the proportion of carbonic-dioxid contained therein, as has already been pointed out."

Scientific Anecdotes.—No. 8.

A New Jersey editor, who was unacquainted with the metric system of weights and measures, and to whom consequently the word "kilometer" was entirely new, read, during the Franco-Prussian war, the cable dispatch that "Bazaine had moved twenty kilometers out of Metz," and while mixing up in his mind the name kilometer with torpedo, mitrailleuse, and other formidable engines of war, wrote an editorial as follows:

"All friends of humanity in warfare will be delighted to hear that all the kilometers have been removed, and that the innocent people of Metz are no longer endangered by the presence of these devilish engines of war—sleeping upon a volcano, as it were." Then he went on to describe some experiments made with kilometers in the Crimea, in which one of them exploded and blew a frigate out of the water.

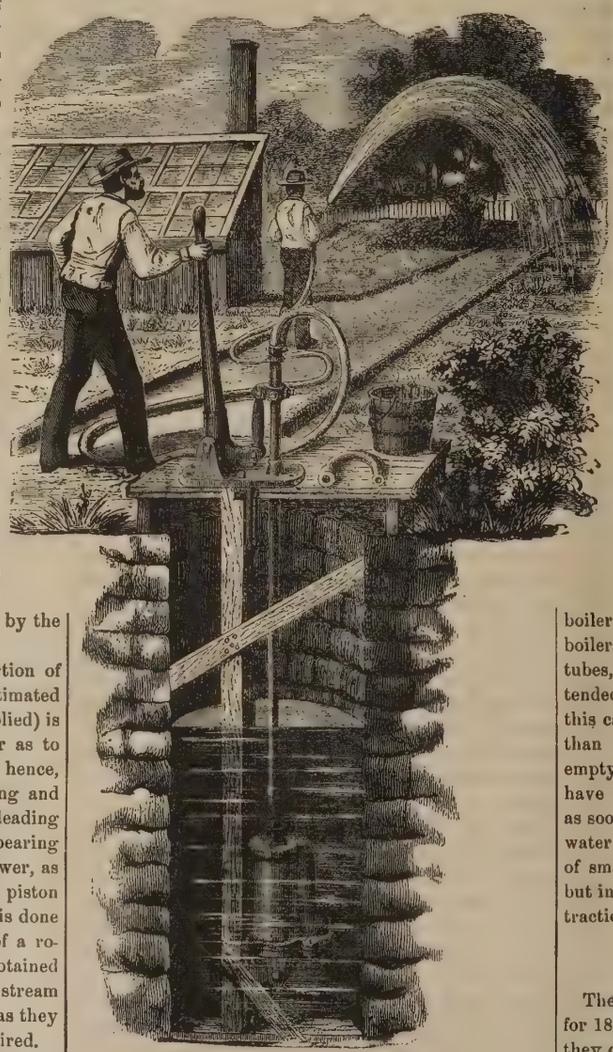
An Incredible Invention.

The *American Manufacturer* reports the invention of a gas machine, for which so much is claimed as to make it incredibly wonderful. It is said to have been patented by J. T. Guthrie, of Leesburg, Ohio, to utilize the gas from bituminous coal otherwise lost with the smoke through the flues and chimneys. The machine is said to be very simple, and can be attached to a common cooking or heating stove. The advantages claimed for it are, that any person can handle it easily, the same fuel used to cook the breakfast producing an abundance of pure gas, sufficient to illuminate the house during the night, without any expense whatever. Mr. Guthrie also claims the right of attaching it to furnaces, grates, and any and all places where coal is used for fuel and heating purposes. It is said that he proposed to the Commissioners of the Cincinnati Exposition to light the entire exposition building with as good and pure a quality of gas as can be produced in the city gas works, and this by using the same fuel that heats the boilers of their power engine, without the cost of one cent for the fuel. It is also said that this invention is in successful operation in Leesburg, that the inventor is visited daily by hundreds of people to see the wonderful machine, and that all, so far, bear testimony to its wonderful merits and general utility. The inventor claims that good, pure gas can be produced by the machine at a cost not to exceed 20 cents per 1,000 cubic feet, and earnestly invites practical men from all parts of the country to come, see, and examine the working of his invention.

Submerged Force Pumps.

There are peculiar advantages connected with the system of submerged force pumps, (one of which we here illustrate). In the first place they will not freeze, as the working parts are under water, and having no piston packing, no water remains in the pipe when not in action; second, the water is their lubricator, so that they do not need any other lubricating material; third, being well made, of the best material and workmanship, consisting of but few parts, and all of metal, they are not subject to derangement, and therefore perfectly reliable, each stroke taking water from the same level at the bottom of the pump; fourth, the smallest size throws water to a considerable distance with one man power, which makes them invaluable as fire extinguishers; fifth, they are adapted to great depths, one man being able to draw water from a depth of 150 feet; sixth, they are easily set in place by any ordinary workman; seventh, they compare favorably with any other pump, as well in regard to capacity as to the power required to work them; and finally they are cheap.

Our engraving represents the pump in operation for irrigating a garden; the body or cylinder of the pump is supplied with water during the upward stroke of the piston, by the puppet valve, the water already in the pump escaping meantime down through the piston head into the stem of the piston, which is hollow, and to it the pipe is attached which moves the piston and acts as conductor at the same time. The piston valves are firmly held on their seats by the pressure of the water, forming a vacuum below the piston, which fills the cylinder with water through the puppet valve. When the return stroke is made, the piston valves shift to their upper seats, while the valve closes, forcing the water in the lower part of the cylinder up into the piston stem, under the valves, while the puppet valve in the side chamber supplies the vacuum formed by the down stroke of the piston, which becomes effectually a solid head by the action of the piston valves.



American Submerged Force Pump.

In the operation of this pump the chief portion of friction due to packing (which it is usually estimated requires at least 33 per cent of the power applied) is saved, the piston being so fitted to the chamber as to act to a considerable extent as an air pump; hence, when submerged in water it has a water packing and water lubrication. The channels for the water leading to the center line of the piston cause an equal bearing on all parts thereof, and a great saving of power, as may be readily shown by closing up one of the piston valves, and taking water from one side only, as is done in some other pumps. The continuous action of a rotary pump is here simply and economically obtained by a plunger maintaining nearly a continuous stream without the use of an air chamber, although, as they are sometimes used, they will be supplied if desired.

This pump received premiums at the American Institute Fair, New York, 1869 and 1870; Charitable Mechanics Fair, Boston, 1865; New England Agricultural Fair, 1867 and 1868, and also at twenty state fairs and fifty county and town fairs. We have also before us testimonials in regard to its capacity as a ship and fire pump. The price of these pumps varies from $10 to $45, according to size and finish, and raise from 12 to 70 gallons of water per minute.

This pump is manufactured for Henry H. B. Bloomfield, 34 Dey street, New York, of whom further particulars can be obtained.

English Plan of Communication Between Cars and Engine.

It appears that our English cousins cannot get it into their heads that our simple and effective system of a bell-rope, in use on all our railroads, is all-sufficient to signal the engineer to start or to stop—the only signals ever communicated to him. As a proof of this the English journals praise the invention of Mr. Powell, of Harrogate, for securing direct communication between passengers, guard, driver and signalmen while the train is running. The invention consists of a light insulated metal rail or bar placed in the center of the 4-foot way, extending from one block station to another, and united to these stations by insulated wires in connection with batteries and instruments placed in the signal cabin, the station master's room, or any other convenient place. In combination with the insulated rail a trailing runner or drag is placed under the engine and guard's van, constructed in such a manner as to be in constant contact with the insulated rail, and connected with batteries and speaking or signalling instruments upon the engine and in the van. By these means conductors and passengers can communicate with the engineer. This is accomplished by fixing under each carriage a suspending runner or drag, with a direct and easy communication from the inside of the passengers' compartment by a connecting cord. In case of danger or alarm, the passenger, by pulling the connecting cord, at once releases the runner, which falls upon the insulated rail or bar, and immediately gives the alarm to the engineer (called in England the "driver") and the guard.

CLEOPATRA'S NEEDLE.—The apparatus for taking down, removing, and placing in perpendicular position in Central Park, New York, the obelisk which has been presented by Egypt to that city has just been completed at the Phœnix Iron Works, Trenton, and shipped for its destination. It consists of two frames composed of roll-iron beams, plates, channels, etc., to support two bearings, upon which are a pair of trunnions, which will be fastened to the obelisk at the center of gravity. When placed in position the foundation will be removed from under the obelisk, and the immense monolith weighing two hundred and five tons, will then be swung in a horizontal position, the same as a cannon, lowered to the ground by jack-screws and placed in a cradle prepared for that purpose. It will then be transported to the seaboard and shipped to New York. There the same apparatus will be used to erect the obelisk in a permanent position. Each of the trunnions weighs seven tons, and workmen have been engaged on them night and day for the last two months.

Care in Emptying Steam Boilers.

In regard to emptying and blowing-off steam boilers, a French contemporary gives the following useful hints: "Those who possess externally-fired boilers, working only by day, have all observed that the fire being covered by night, and the doors closed, the pressure rises during the night, often sufficient to open the valves. This shows that the masonry, being at a much higher temperature than the boiler which it envelops, imparts to it some of its heat. The same effect of heating the boilers is produced, to a less degree it is true, but nevertheless to some extent on the outer jacket of internally fired boilers. It is, consequently, injurious to empty boilers soon after having stopped them, because after emptying, the plates would be heated by the action of the masonry. It is well to admit a current of air through the flues some hours after the stoppage of the generator, and not to empty it before the flues become cooled to a temperature below 300°. When the flues are not too hot, no serious inconvenience is experienced in emptying the boiler under pressure. We do not say at high pressure, as for a boiler the pressure of which would be 10 pounds, the temperature of the water being 304°, a greater quantity of steam would be generated during the process of emptying; we think at a pressure of 2 pounds the boiler could very well be emptied. In internally fired boilers, as there is no masonry to cool in the furnace tubes, it would be well to admit the current of air intended to cool the masonry behind the boiler, as in this case the furnaces would be cooled more rapidly than the jacket. We have sometimes seen owners empty their boilers almost immediately after the fires have been extinguished, clean them with cold water as soon as they were empty, and keep up a current of water so that the workmen might work there. Boilers of small dimensions sometimes resist such treatment, but in large boilers it will be seen that unequal contractions must take place, causing the rivets to burst."

Belgian National Exhibition.

The managers of the Belgian National Exhibition for 1880, to be held in Brussels, have announced that they cannot receive any more applications; the number of applications is already considerably over 4,000, surpassing all former exhibitions and expectations.

The committee will establish a permanent exhibition of the intellectual labors of the country, by founding a library in which a complete collection will be preserved of all books on science, art, history and literature; this, by the side of the artistic and industrial objects, is expected to be highly useful and interesting. They think that a library containing all that has been written in Belgium since its establishment as a separate kingdom will be the pride of that nation. The catalogue of the library will be edited in such a way as to form a complete national bibliography, an enterprise which thus far has been attempted in vain.

UTILITY OF THE TELEPHONE.—So common did the use of the telephone become in Newport during the past summer, that more than two hundred instruments were in daily use, the owners of which could communicate at a moment's notice with grocers, druggists, fishmongers, jewellers, tailors, florists, dentists, etc.

Building Intelligence.

New York City Building Items.

At the corner of Forty-first street and Broadway a large concert hall covering an area of 100x185 feet is to be built for the Metropolitan Concert Company.

The site of the old National Hotel on Cortlandt street will be occupied shortly by a new fire-proof office building. It is to be six stories high, covering a plot of ground 65x123 feet, and will be fire-proof throughout. The front will be of Indiana limestone, which has been tested as an excellent building material and is quite pleasing to the eye. The ground floor especially will be elaborately ornamented and the upper offices will all have ample light and ventilation.

The reports of the proposed apartment-house to be built for Edward Clarke, president of the Singer Sewing Machine Company, have taken a definite shape, and H. J. Hardenbergh is now busy on the plans. Exactly what style and materials will be used has not been decided upon, but the building will cover an area of 100x150 feet, and will, it is said, be the most perfect of its kind yet built. It will stand at the corner of Seventy-fourth street and Eighth avenue, and the suites will be larger than those in the Vancorlear Building, and very elaborately finished. They are expected to rent at from $3,000 to $5,000 per annum. There will be a court in the center on the French plan, and no cost will be spared in the construction of the building.

A number of capitalists have formed a stock company which is called "The Universal Conservatory and Zoological Garden Company," with a capital stock of $2,000,000, for the purpose of erecting an immense amusement palace in connection with a zoological and botanical garden. They have purchased thirty-three acres of ground lying between One hundred and Fifty-fifth and One Hundred and Fifty-ninth streets, St. Nicholas avenue and the Harlem River, for which they paid $400,000. The main building will be erected near the corner of St. Nicholas avenue and One Hundred and Fifty-fifth street and will be constructed in the Gothic and Moorish styles and will seat 18,000 people. On the upper floor will be a grand restaurant capable of seating 2,000 persons, and below this restaurant are to be bowling alleys and billard rooms. To the right of the corridor is to be a large concert hall. To the east of the main entrance will be the botanical department, which will be 100 feet wide and 500 feet long, with towers on each end filled with birds and flowers. A piazza will surround this building. An observatory will be north of the building and will be 385 feet above the level of Eighth avenue, having two verandahs for promenading. The top will revolve and will contain a large telescope. Two elevators will run to the top and a bazaar will be below for the sale of nick-nacks, etc. There is to be a deep ravine to the north of this tower which will be for birds that love darkness, and a milk dairy will be on the bluff beyond. A mammoth arcade will be erected fronting on Eighth avenue, to the extent of 1,100 feet, fronting 450 feet on One Hundred and Fifty-fifth street. The building will be of iron and glass and will be forty feet high and seventy feet deep. The grand entrance will be on One Hundred and Fifty-seventh street, with side entrances on One hundred and Fifty-fifth and One Hundred and Fifty-ninth street. At the top of the entire building will be a promenade, with gardens and rustic seats. The whole structure will cost $275,000. Another promenade, back of the arcade and twenty-five wide feet, will be for the cages of the zoological department. Mr. L. R. Martinez, who laid out the Zoological Garden of Philadelphia, will draw plans for this garden, while Mr. Hugo Kafka, an Austrian engineer, and landscape artist, will lay out the grounds, etc. It is promised that this new enterprise will far surpass anything of its kind in the world and that no expense will be spared to accomplish this end.

Miscellaneous.

St. Mary's Church at Bergen Point, N. J., is to be built on a new site, in that place, at a cost of about $35,000, L. J. O'Connor, of New York, architect.

There is great activity in building at Bar Harbor, Maine's great watering-place, fifty buildings now being in course of erection.

I. Gilchrist, in conjunction with the Messrs. Newsom of San Francisco, is the architect for the new opera house at Napa, Cal., the cost of which will be $25,000.

Carl Pieffer of New York, architect, is now receiving estimates for Pavilion No. 2 of the State Homœpathic Association for the Insane at Middletown, N. Y., the cost of which will probably be $125,000.

Next spring the Baltimore & Ohio Railroad Company will begin to build a large five-story brick building, at Baltimore, for the company's offices on the corner of Calvert and Baltimore streets.

W. L. B. Jenney, of Chicago, is the architect of a new museum to be built at Ann Arbor, Mich. It will be entirely fire-proof, 47 feet 6 inches by 120 feet, three stories and mansard, with a tower over the front entrance 114 feet high; cost, $40,000.

Work on the residence of Cornelius Vanderbilt at Hartford, Conn., has been commenced, and the building will probably be ready for occupancy next July. It is to be of three stories with slate roof. The total cost is expected to reach $50,000.

The Jessup & Moore Paper Manufacturing Company have purchased in Philadelphia the property on the northwest corner of Sixth and Jayne streets, and will tear down the present building and build a fine, commodious brick structure as soon as possible.

About three hundred dwelling houses are now being erected at Washington, D. C. Twelve or fifteen are very fine, and, when completed, will be among the most beautiful in the city. It is computed that the amount expended this year in Washington will reach $1,800,000.

Wm. H. Beers, architect, 150 Broadway, New York, is building some thirty five-roomed two-story Queen Anne laborers cottages on 17th and 18th streets, near 7th avenue, Brooklyn, and near the factory, recently erected by the Ansonia Clock Company. The cottages are 16.8x33 feet in depth, with hot and cold water on first floor, and built in a substantial manner; $500 per house. Mr. L. Squier is the builder.

The Pennsylvania Railroad Company propose to build a monster hotel at the eastern terminus of the elevated road in Philadelphia. It is to occupy the plot of ground on the west side of Broad street, from Market to Filbert streets, and is to be connected with the company's depot by light bridges thrown across Fifteenth street. Everything about the hotel is to be first class. As soon as the plans of the company are approved, the work will be begun, and not less than 2,000 men will be employed during this winter, if the consent of the city authorities can be secured in time.

A new post-office is to be built at Baltimore, the plans for which are about complete. The structure will be three stories high, with main front on Calvert street, and entrances on Fayette and Lexington streets. The first floor will be for the use of the post-office, the second and third floors for the United States court room and all the Federal offices except the Custom house. Elevators capable of rising 100 feet a minute are among the features enumerated. It is proposed to build it of Baltimore county marble.

The Long Island Historical Society building on the corner of Pierrepont and Clinton streets, Brooklyn, now approaching completion, will be an ornament to that city. Without being pretentious in appearance, its entire construction at once reflects the purposes for which it is to be used. The three principal stories will be devoted to a lecture room, to a library and to a museum, the latter in the upper story. The walls, which are four feet thick and elaborately trimmed with terra cotta, are started on a bottom of Wyoming Valley stone—a gray stone of excellent quality, which is susceptible of very fine carving. The brick of the walls are all laid in black oil putty instead of black mortar. Along the front wall will be the heads of Michael Angelo, Beethoven, Columbus, Shakespeare, Franklin and Gutenberg, by Warner, of this city, and Bartlett of Boston, both sculptors of repute. In the spandrels will be represented the various agricultural products of the country, such as wheat, Indian corn, etc., while all along there will be terra cotta panels. The entire structure is to be surmounted by an ornamental tower, 100 feet from the ground. The lecture room will be finished in ash and cherry, the stained glass furnishing a most pleasing light to this story.

Prices of Building Materials.

The greatest rise in prices has been in articles of hardware, and so far as these enter into the construction of a house, the builder finds that his estimates must be very materially increased. Nails are seventy per cent higher to-day than they were at the beginning of the present year. Window-weights have advanced fully seventy-five per cent; locks and knobs have risen nearly 45 per cent upon the average; tacks and kindred goods, 25 per cent; common door butts and hinges fully 100 per cent; and such other odds and ends of hardware as are used in building, an average of no less than forty per cent.

Common window glass, either French, German or American, cannot be bought to-day within 20 per cent as cheap as it could on the first of January. A box of glass, suitable for sashes 15x30 inches in dimensions, costs $3.90 to-day, against $2.98 at the beginning of the year; a box for 10x15 sashes costs $2.70 to-day against $2.10 on the first of January; and a box of glass for 13½x26 sashes costs $3 now, against $2.50 when the year opened. Sashes, doors and blinds have recently undergone a very material advance. Blinds had been unprofitably low, and the present prices constitute a rise of from thirty to forty-five per cent. A blind upon which the combination price was lately fifty cents now costs sixty-five; those which formerly sold for seventy now sell for ninety; and those which formerly sold for seventy-eight cents now sell at $1.10. Sashes with glass ready set, are over thirty per cent dearer to-day than at the beginning of the year.

Doors are constantly advancing, and it is difficult to keep the run of the new prices which are made by the manufacturers.

In brick there has been, since the first of January, an advance on some grades of common of over 30 per cent; but in lime, sand and cement there has been very little variation, and the same may be said of paints and oils. In all these articles, however, there is a hardening tendency, and it may be generally said of them that, though there has been very little nominal advance, yet figures which could often be obtained upon them six or eight months ago, are not possible to-day. In "dull times" it frequently happens that dealers are willing to give quiet concessions to customers for the purpose of securing trade when there has apparently been no actual decline in prices; and, upon the other hand, when business begins to improve, the firmer feeling which prevails renders such concessions difficult to obtain, even though prices are not quotably higher. The estimates which builders were able to furnish last winter and spring, therefore, were lower than to-day, not only because of the advance which has actually since occurred in some materials, but because of the concessions which were then possible in others.

Ordinary building lumber, and shingles, clapboards, etc., are not quotably higher to-day than at the beginning of the year, but the eastern mills are generally running full and are approaching a position where they can take their pick of orders. In the West a material advance has occurred on finishing stock, and the retail dealers are talking of a corresponding advance here.

Hardwood lumber for finishing purposes, is also firmer, and ash and cherry will cost some five per cent more than on the first of January. Black walnut sells to-day at about the same price as at the beginning of the year, but it has recently advanced to that figure after a decline of from three to five per cent.

The cost of plumbing a house to-day is from twenty to twenty-five per cent greater than on the first of January.

Latest Market Report of Building Materials.

NEW YORK PRICES.

ARTICLES MARKED WITH A STAR (*) ARE QUOTED IN GOLD.

—o—

LUMBER.

Pine, very choice and extra dry, per M	$55 00 a 60 00
Pine, good	45 00 a 50 00
Pine, shipping box	18 00 a 22 00
Pine, common box	15 00 a 17 00
Pine, common box, ⅝	13 00 a 15 00
Pine, tally plank, 1¼, 10 inch, dressed, each	35 a 40
Pine, tally plank, 1¼, 2d quality	35 a 38
Pine, tally plank, 1¼, culls	25 a 28
Pine, tally boards, dressed, good	28 a 30
Pine, tally boards, dressed, common	22 a 25
Pine, tally boards, culls, dressed	21 a 23
Pine, strip boards, merchantable	16 a 18
Pine, strip boards, clear	22 a 25
Pine, strip plank, dressed, clear	33 a 35
Spruce boards, dressed	18 a 20
Spruce plank, 1¼-inch, dressed	22 a 25
Spruce plank, 2-inch,	28 a 34
Spruce wall strips	13 a — 15
Spruce timber, per M	16 00 a 19 00
Hemlock boards, each	14 a — 16
Hemlock joist, 2½x4	15 a — 16
Hemlock joist, 3x4	16 a — 18
Hemlock joist, 4x6	40 a — 44
Ash, good, per M	38 00 a 45 00
Oak	38 00 a 45 00
Maple culls	20 00 a 25 00
Maple good	42 00 a 45 00
Chestnut	42 00 a 48 00
Cypress, 1, 1½, 2, and 2½-inch	35 00 a 40 00
Black walnut, good to choice	85 00 a100 00
Black walnut, ⅝-inch	75 00 a 85 00
Black walnut, selected and seasoned	110 00 a150 00
Black walnut counters, per ft	12½ a 25
Cherry, wide, per M	85 00 a100 00
Cherry, ordinary	60 00 a 80 00
White wood, chair plank	60 00 a 70 00
White wood, inch	40 00 a 50 00
White wood, ⅝-inch	30 00 a 35 00
White wood, ⅝ panels	35 00 a 40 00
Shingles, extra sawed pine, 18-inch	4 00 a 5 00
Shingles, clear sawed pine, 16-inch	3 75 a 4 00
Shingles, cypress, 24x6	18 00 a 21 00
Shingles, cypress, 20x6	10 00 a 12 00
Lath, Cargo rate	1 40 a 1 45
Yellow dressed pine flooring	25 00 a 30 00
Yellow pine girders	30 00 a 40 00
Locust posts, 8 feet, per inch	18 a 20
Locust posts, 10 feet	24 a 25
Locust posts, 12 feet	29 a 34
Chestnut posts, per ft	3 a 3½
Basswood per M	25 00 a 30 00

Cargo rates, 10 per cent off.

BRICKS.

	Cargo.	Afloat.
Pale, per M.	— — a	4 00
Jersey	4 75 a	5 25
Up Rivers	5 25 a	5 62
Haverstraw Bay	5 75 a	6 00
" " choice	6 00 a	6 25
Favorite Brands	6 50 a	7 50
Hollow Fire-Clay Brick	9 00 a	9 25

FRONTS.

Croton—Brown, per M.	7 50 a 8 50
" Dark	8 50 a 9 50
" Red	9 00 a 9 50
Philadelphia	26 00 a 28 00
Trenton	24 00 a 29 00
Baltimore	34 00 a 38 00
Clark's Ottawa White	25 00 a — —

Yard prices 50 cents per M higher, or with delivery added $2 per M for hard and $3 per M for front brick. For delivery add $5 on Philadelphia and Trenton, and $6 on Baltimore brick.

IRON—PER TON.

Duty.—Bar, 1 to 1½c. per lb.; Railroad, 70c. per 100 lbs.; Boiler and Plate, 1½c. per lb.; Sheet, Band, Hoop and Scroll, 1¼ to 1¾c. per lb.; Pig, $7 per ton; Polished Sheet, 3c. per lb.; Galvanized, 2½c. per lb.; Scrap Cast, $6 per ton; Scrap Wrought, $8 per ton—all less 10 per cent. No Bar Iron to pay a less duty than 35 per cent ad val.

Pig, Scotch—Coltness	30 00 a — —
" Glengarnock	28 50 a — —
" Eglinton	27 00 a — —
" American, No. 1	29 00 a 30 00
" American, No. 2	27 00 a 28 00
" American, forge	25 00 a 26 00

	Store prices.	Cash.
Bar, Swedes, ordinary sizes	— 5½ a —	5¾
Bar, Swedes, nail-rod	— 6 a —	6¼

LEAD—PER 100 POUNDS.

*German	— — a — —
*English, common	— — a — —
*Spanish	— — a — —
*Foreign, refined	— — a — —
*Bar	5 00 a — —
*Sheet and Pipe	5 00 a 6 00
*Domestic	3 37 a — —

NAILS—PER KEG.

10d to 60d, common, fence and sheathing	2 30 a — —
8d and 9d, common	2 85 a — —
6d and 7d, common	3 10 a — —
4d and 5d, common	3 35 a — —
3d and 4d, light	4 10 a — —
3d, fine	4 85 a — —
2d, fine	4 85 a — —
Cut spikes, all sizes	2 85 a — —
Clinch nails, 1½ to 1¾ inch	5 00 a 5 25
do. 2 to 2¼ inch	4 75 a — —
do. 2½ to 2¾ inch	4 50 a — —
do. 3 inch and longer	4 25 a — —

TIN PLATES.—Duty, 1 1-10 cents per pound.

*I. C. charcoal, 10x14, per box	7 50 a 7 75
*I. C. coke, 10x14	6 50 a 7 00
*I. X. charcoal, 10x14	9 50 a 9 75
*I. C. charcoal, 14x20	7 50 a 7 75
*I. X. charcoal, 14x20	9 50 a 9 75
*I. C. coke, 14x20	6 50 a 7 00
*I. C. coke, terne, 14x20	6 50 a 6 75
*I. C. charcoal, terne, 14x20	6 75 a 7 00

ZINC.—Duty, sheet, per lb., 2½ cents.

Sheet, (cask) per lb	— 6⅞ a — 7
Sheet, (open)	— 8 a — —

SOLDERS.

No. 1	— 12 a — 13
No. 2	— 11½ a — —

STONE.—Cargo Rates.

Amherst Freestone, in rough, per cubic foot	— — a — 85
Berlin Freestone, in rough	— — a — 95
Berea Freestone, in rough	— — a — 75
Brown-Stone, Portland, Conn	1 25 a 1 50
Brown Stone, Belleville, N. J	1 00 a 1 50
Granite, rough	— 60 a 1 25
Canaan Marble	1 25 a 1 50
Dorchester, N.B., Stone, rough, per foot	— — a 1 00

PAINTS.

*Carmine, American, per lb. gold	6 00 a 6 25
Chalk, per lb.	— 00⅜ a — 00½
China Clay, per ton gold	20 00 a 22 00
Chrome yellow, dry, per pound	— 12½ a — 28
Lead, red American, per pound	— 8 a — 9
Lead, white American, pure, in oil	— 8 a — 9
Lead, white American, pure, dry	— 7¾ a — 8½
Lead, white English, pure, in oil gold	— 9½ a — 10½
Litharge	— 7 a — 8
*Ochre, Fr., dry, per 100 lbs	1 50 a — —
Ochre, ground, in oil, per lb	— 6 a — 15
Ochre, Vermont, per 100 lbs	— 75 a 1 00
*Orange Mineral, English gold	— 9½ a — 10
Paris White, American	— 1½ a — 1¾
Paris White, English, prime	— 2 a — 2¼
Paris Green	— 15 a — 28
Plumbago paint, patent, per lb	— — a — 25
Putty, per lb	— 1¾ a — 2½
Spanish Brown, dry, per lb	— 1⅜ a — 1¼
Spanish Brown, ground in oil, per lb	— 8 a — 9
Venetian red, per cwt	1 75 a 2 00
*Vermilion, Chinese, per lb	— 90 a 1 00
*Vermilion, Trieste	— 80 a — 90
*Vermilion, quicksilver, bags gold	— 65 a — 67
Vermilion, American, common	— 15 a — 18
Whiting, per 100 lbs	— 50 a — 80
Zinc, white American, dry, No. 1	— 5 a — 7½
Zinc, white American, No. 1, in oil	— 8 a — 10
*Zinc, white French, dry, (Red Seal,) gold	— 8 a — 8¼
Zinc, white French, in oil gold	— 10 a — 10½

VARNISHES—PER GALLON.

American Wearing Body	3 50 a 4 00
Coach Body	2 35 a 3 50
do do	1 80 a 2 00
Furniture	1 25 a 2 50
Black Asphaltum	1 00 a 1 50
Brown Japan	1 00 a 1 20
Liquid Paint Dryer	1 35 a 1 75
Harness, (black)	3 00 a 4 50
Shellac, Spirits	3 00 a 3 50

CEMENT—PER BARREL.

Portland (imported)	2 75 a 3 50
Portland (American)	2 50 a 2 75
Portland (Spanish)	2 50 a 2 75
Portland (Lafarge)	3 20 a 3 40
Portland (German, Bonner)	2 75 a 3 25
Lime of Tiel	2 20 a 2 30
Lime of Tiel, per ton	15 00 a 18 00
Roman	2 75 a 3 25
Keene's, coarse	6 50 a — —
" fine	10 50 a — —
Martin's, coarse	6 00 a — —
" fine	10 50 a — —
Rosendale	— 90 a 1 00

DEADENING AND ROOFING MATERIAL.

Mineral Wool for Roofs and Deadening, per lb. — 1¼ a — 1½

HAIR.

Cattle, per bushel of 7 lbs	— 9 a — 12½
Goat, " "	— 15 a — —

SLATE.

Purple roofing slate, per square	$6 00 a 7 00
Green slate	6 00 a 7 00
Red slate	10 00 a 11 00
Black slate, Pennsylvania, (at Jersey City)	5 00 a 5 25
" " Cargo rate	3 25 a 3 75
Slate tiles, 1¼-inch, rubbed, per square foot	20 a — 25

PLASTER PARIS.

Duty.—20 per cent ad. val. on calcined; lump free.

Nova Scotia, white, per ton	2 90 a 3 00
Nova Scotia, blue	2 80 a 2 85
Calcined, Eastern and city, per bbl	1 00 a 1 15
Calcined, city casting	1 20 a 1 25
Calcined, city superfine	1 30 a 1 50

LIME—PER BARREL.

State, common	— 60 a — 65
" finishing	— 80 a — 85
Rockland, common, cargo rate	— 75 a — —
" finishing	— 85 a — —
Ground	— 65 a — 70

Add 25 cents to above figures for yard rates.

FOREIGN WOODS.

MAHOGANY.

St. Domingo, crotches, ordinary to good, per ft	— 15 a — 20
St. Domingo, crotches, fine	— 20 a — 30
St. Domingo, logs, small	— 5 a — 8
St. Domingo, logs, large	— 20 a — 30
Frontera, Mexican, large	— 11½ a — 16
Frontera, Mexican, small	— 8 a — 10
Other Mexican	— 8 a — 14
Honduras	— 10 a — 15

ROSEWOOD.

Rio Janeiro, ordinary to good, per lb	— 2½ a — 8
Rio Janeiro, good to fine	— 5 a — 8
Bahia, ordinary to good	— 2 a — 6½
Bahia, good to fine	— 4½ a — 8
Honduras, per ton	10 00 a 20 00
Satin Wood, per foot	— 15 a — 60
Tulipwood, per lb	— 6 a — 12½
Lignumvitæ, small, per ton	10 00 a 20 00
Lignumvitæ, large	25 00 a 50 00

CEDAR.

Cuba, per superficial foot	— 12½ a — 16½
Mexican, small	— 8 a — 10
Mexican, large	— 10 a — 16
Florida	— 50 a 2 00

DRAIN AND SEWER PIPE.

(Delivered on board at New York.)

Discount 50 to 60 per cent, according to quality and size of order.

PIPE, per running foot.

2 inches diameter,	$0 13	10 inches diameter,	$0 70
3 "	0 16	12 "	0 80
4 "	0 20	15 "	1 25
5 "	0 25	18 "	1 60
6 "	0 30	20 "	2 00
7 "	0 35	22 "	2 50
8 "	0 45	24 "	3 00
9 "	0 55		

GENERAL REVIEW OF THE MARKETS.—The building markets partaking of the general return of business prosperity have been very active the past month, and prices have advanced on most of the principal articles under review, as will be seen by our prices-current, to which many important additions to cost have been made. Those who were fortunate enough to build during the business depression, when prices had touched the lowest figures, are now reaping the benefit of their foresight; a building which a few months ago could be built for ten thousand dollars, we are informed by reliable architects would cost now at least 20 per cent more or twelve thousand dollars, and the probabilities are that a still greater disparity will exist before the lapse of another month. A very careful analysis of the increase in the cost of material appears in another part of this number, this department being insufficient for the publication of so detailed an article here. This reaction in prices too, like that experienced in general business is a healthy one. This is shown by the freedom of the markets from excitement or flurry even in the face of most "bullish" reports, and the improvements made have been of that slow, solid character which seems likely to make them more enduring.

THE MARKETS IN DETAIL.—In the lumber market trade has been brisk and dealers in most cases have "held their end up" first rate in comparison with other branches of trade in the city. Values in some instances have advanced especially those coming under the influence of winter freight charges. The amount of stock in the city is gradually swelling into fair proportions, though some dealers have concluded to make their accumulation rather smaller than originally, by allowing some purchases to remain at primary points until Spring.

In the brick market trade has had a firm tone throughout. Arrivals have been somewhat irregular, but were they great or small buyers always appeared to be waiting, and the offerings found a place as soon as made. Most of the reports from the points of manufacture are of a nature to convey the idea of a scarcity, and it is likely that the amount carried over by the brick makers this fall will not show a remarkably full aggregate, but still the quantity will exceed the production of a few weeks ago, as the very mild and open weather has prolonged the opportunities for manufacture to a considerable extent.

In the lime market business has been still of a somewhat unsatisfactory character to the selling interest, this being one of the articles to which no additions to cost have yet been possible. Almost all the stock as it has come to hand has, however, found a ready outlet, and some cargoes have been sold to arrive, but competition is so sharp that there has been no profit to speak of left for the seller.

In the lath market there is little or nothing to report of a new or interesting character. Dealers are pretty well stocked, but will have to increase their accumulations for winter supply.

In the cement market we retain our old figures; trade has been good and prices in most cases firm.

In the hardware market the volume of business has been full, and values strong with the tendency still upward.

In the metal markets we have to note the greatest increase in cost of any of the articles under review; the rapid improvement they have undergone is a remarkable instance of the general revival. The best Scotch pig-iron which, at our last writing, was quoted at $26a$27 cannot now be had under $30, while for American $29a$30 is now asked, where last month $25a26 was quoted. The market shows great strength at this writing, and we anticipate still further additions to cost next month. Domestic pig lead has been firm and important additions to cost are made all around. Pig tin has been buoyant, while tin plates have sold with much freedom, and prices have advanced very considerably.

In the paint market trade has been fair, while values on pretty much all the leading grades have favored the seller.

Home Department.

A Dangerous though Popular Eye Water.

It is a popular impression that a dilute solution of sugar of lead, or acetate of lead, is a perfectly harmless application for any slight inflammation of the eyes. The time was when it was so regarded by physicians, who were in the habit of ordering a little acetate of lead dissolved in rose water, with perhaps a few drops of laudanum added, for these ocular ailments. But the use of the lead salt for this purpose was long ago condemned by the best authorities, and most physicians are now aware of the fact. In domestic medicine, however, new ideas are slow in replacing the old ones that have come down from our grandmothers, and sugar of lead is still a favorite basis for home-made eye-water.

A recent article in the Philadelphia *Medical and Surgical Reporter*, by Dr. W. S. Ross, gives a succinct statement of the reasons why this use of lead salts is dangerous. The Doctor says that the great danger of the use of lead in the eye is that a deposit often takes place on the cornea, especially if the cornea is in least abraded, from whatever cause. Ulceration of the cornea is a very common occurence, especially where there is high inflammation in the conjunctiva and sclerotic. If the acetate of lead is used in solution, in an ulcerated condition, it does not matter of what strength, there will be a deposit of albuminate of lead the entire extent of the cornea denuded.

The opinions of quite a number of distinguished medical writers are quoted to the same effect. One writer says: "This bad effect may result from a single application. The deposit is extremely apt to fix itself on ulcers of the cornea. It attacks every abrasion on the slightest denuded surface. Hence, when such exist, acetate of lead should never be used.

This deposit resembles wet chalk, and can be removed only with difficulty and at considerable danger to the sight of the eyes, especially if the patient is advanced in years.

A DANGEROUS THOUGH POPULAR HAIR DYE.

We clip the preceding article from a contemporary, and have to add that the same dangerous substance is used in various kinds of hair dyes and hair restoratives, which result in inflammation of the eyes. We have in several instances traced the cause of sore eyes to the hair washes used, which contained sugar of lead, nitrate of silver, or other similar irritating substances. The best advice we can give is to *beware of hair washes and eye waters.*

Hot and Cold Baths.

The London *Lancet*, in a recent number, points out the difference between the effects of hot and cold baths. The effects of the cold bath, it says, being mainly due to impressions made upon the cutaneous nerves, the modifications of the cold bath largely depend on their power of increasing its stimulating action. The colder the water, the more violent the impression. The frequent change of water, such as is found in the sea or in running streams, increases the stimulating effect. Great force of impact, as when water falls from a hight or comes forcibly through a hose upon the body; the division of the stream, as is seen in shower baths and needle baths, and the addition of acids or salt to the water, all act, it would seem by increasing the stimulating power which the water exerts upon the cutaneous nerves. Warm baths produce an effect upon the skin directly contrary to that brought about by cold water. The cutaneous vessels dilate immediately under the influence of heat, and although this dilation is followed by a contraction of the vessels, this contraction is seldom excessive; and the ultimate result of a warm bath is to increase the cutaneous circulation. The pulse and respiration are both quickened as in the cold bath. The warm bath increases the temperature of the body, and, by lessening the necessity for the internal production of heat, increases the call made upon certain vital processes, and enables life to be sustained with a less expenditure of force. While a cold bath causes a certain stiffness of the muscles, if continued for too long a time, a warm bath relieves stiffness and fatigue. The ultimate results of hot and cold baths, if their temperature be moderate, are about the same, the difference being, to use the words of Braun, that "cold refreshes by stimulating the functions, heat by physically facilitating them; and in this lies the important practical difference between the cold water and hot water systems."

John Rogers' Groups of Statuary.

One of the greatest merits of our famous sculptor, Mr. John Rogers, is that his subjects are so widely different, and always reveal the same master-hand, which consists in truthfulness to nature, however difficult the subject. The group of which we give an engraving, represents one of the very difficult subjects referred to —horses at full galop. The group represents two polo players; the rider in the background is trying to take the ball past the flag, and thus win the game; but his opponent in the foreground comes just in time to prevent this.

THE POLO PLAYERS.

We ought to add that, on account of the fragility of the material of which the figures are made, the flags, staffs, and all parts liable to injury, are made of metal, or strengthened by interior metal rods. The whole group is 21 inches high by 16 wide, weighs when packed 120 pounds, and costs $15.

Mr. Rogers has his gallery now at 23 Union Square, where can be seen all of the many groups which have made his name a household word.

Blisters a Remedy for Diphtheria.

The method of treating that form of pulmonary consumption which consists in ulceration in the substance of the lungs, by means of blisters on the chest, and thus giving an artificial outlet to the humors which otherwise discharge from the lungs, has successfully been applied to various other diseases in which vital organs were attacked. Even various forms of internal inflammation may in this way be drawn to the exterior, and the latest application of this method has been made with diphtheria. According to the *Salem* (Mass.) *Gazette*, Dr. Davis, of Mankato, Minn., blisters the chests of his patients suffering from diphtheria, and the ulceration which otherwise takes place in the throat, will appear on the chest, while the throat becomes free. He discovered this while treating a wounded man, who got diphtheria before his wound was healed, and the suppuration appeared in the wound and not in the throat.

Misdirected Letters.

A good deal of anxiety has been caused in business circles by newspaper statements concerning a recent order of the Postmaster General, to the effect that letters with incomplete or wrong addresses should be sent to the Dead Letter Office, without any attempt on the part of officers or clerks to forward them to their destination. It has been stated that letters would be thus detained if the county, as well as the town and State, was not given in the address. In point of fact, no such thing was ordered or contemplated. The instructions of the Postmaster General are to the effect that when letters are not addressed to a post office, or by the omission of the State or other imperfection in the addressing, their proper destination cannot be determined, they shall be sent to the Dead Letter Office. This is entirely proper. Suppose, for example, a letter is mailed in New York addressed to John Smith, Middletown. There is at least one Middletown in every State which has a post office, and under the old system it would be sent wandering around from one Middletown to another, at great expense of time and trouble.

The carelessness often displayed in addressing business letters is simply amazing. Bushels of letters are sometimes thrown out at one assorting in the New York Post Office, some sealed without any address, some half addressed, and many bearing the names of localities which have no post offices, and are not, properly, geographical designations, except in colloquial usage. A wagon-load a day would scarcely exceed the amount of matter reaching the New York Post Office which can only be forwarded by guess, if at all. The addition of the county to the address facilitates distribution and dispatch, but it is not made the condition of forwarding. All the department wants is that letters shall be addressed to some post office in some particular State. If this is not done, letter-writers have no reason to complain if their letters miscarry.

We learn that mistakes have occurred since the promulgation of the Postmaster General's order, where postmaster's in small towns have interpreted the new law in its letter rather than in its spirit, and have returned to the writers for "better direction" letters addressed to New York City where the State was omitted. The Postmaster General's attention has been called to this manifest blunder, and he has replied that New York City is a sufficient address, and has instructed postmasters throughout the country accordingly. The great danger of a new law of this kind lies in its misconstruction by men who have not the judgment to comprehend its clear intention. Who, in addressing a letter to New York City, would think of adding New York State? There being but one New York in the United States, can any one possibly conceive why there should have ever been any doubt about letters directed "New York City," being intended for any other place. However, the blunders of office-holders are proverbial; they run in ruts, so to speak. Once in a certain track, they never leave it; they work by machine power rather than by mental action.

DRESSMAKING IN SCHOOLS.—The School Commissioners of Indianapolis, after a careful investigation of the matter, have voted to introduce a novel feature into the advanced grades of the girls' school, which is nothing more or less than the somewhat intricate science of dressmaking. It seems that Mrs. Jackson, a lady of standing in that city, has invented a system of dress cutting and fitting which she believes to be adapted to schools, and has asked the privilege of trying an experiment in that direction—the system being entitled the "Science and Geometry of Dress." After mature deliberation the school authorities have decided to accede to the lady's proposal, have purchased a number

of her text books and have further made twelve lessons of one hour each in dress fitting and cutting a part of the course in two grammar schools for one term. The lady who has invented the system will instruct the classes.

The Cincinnati Exhibition.

The seventh annual Cincinnati Industrial Exhibition opened on the 10th of September and closed October 11th. It proved one of the most interesting and successful fairs that has taken place in that city, the results in every way having exceeded the most sanguine expectations. The opening was most auspicious, the President and others of prominence taking part in the ceremonies. The buildings were tastefully arranged and exhibits fine and numerous, every space being occupied by displays of a most interesting character, contributed largely, of course, by the West. The machinery department was very complete, all the prominent manufacturers of that section, and many from the East being represented. The display of woodworking machinery was particularly fine. A marked feature of interest was the exhibit of Cincinnati pottery, which was of native clays, decorated by amateur artists in ceramics. Specimens were shown in incised and relief decoration, in underglass painting on Rockingham ware, and in enamelled faience.

The American Institute Fair.

The present fair of the American Institute does not compare at all favorably with the exhibitions of former years, and in fact we think it pretty generally conceded that since the Centennial Exhibition the American Institute fairs have been growing steadily poorer. The reason of this is perhaps to be accounted for in the fact that less interest is taken in local fairs than before the the great International Exhibition was held, and overshadowed everything this country had every seen. Still this last remark is not expressed as an assertion, but merely as a possible explanation, and even if true when applied to the American Institute it does not hold good in all cases as evidenced by the great success of the Cincinnati fair this year. Perhaps the causes are to be looked for elsewhere; one explanation that has been given us frequently by manufacturers is that the class of people who visit the Institute fairs are not practical men or men, who are interested in, or who want machinery, but are, as a rule, sight-seers, the former class being kept away by a dearth of attractions. It will be replied that this is not the fault of the management, as they open their doors to all alike. This is no doubt true so far as it goes, but certain it is that the machinery department is not what it should be in order to command the attention of the practical portion of our people, and unless some steps are taken to secure the more general representation of our manufacturers, we fear that it will not be long before the jigsaw man with his toys, the cider man, and others ready to catch the pennies of the crowd, will have monopolized the best part of a department which at one time was, to say the least, not discreditable to our city Surely New York should not be outdone by her Western sister cities. Let us look to our laurels and have next year a fair that will be a credit to us, and one such as an enterprise and ingenuity is deserving of.

It is to be hoped, too, that the price of admission will hereafter be placed at a reasonable figure. At Cincinnati only 25 cents is charged, and we see no reason why double that sum should be demanded here, although people might gladly pay it were the same attractions offered as at Cincinnati. Still, 25 cents is enough in any case, and would pay the management better in the end, to say nothing of the material benefits the reduction would confer upon those people in moderate circumstances who are now debarred from taking their families, on account of the high rate of admission.

In spite of all its drawbacks, there are some very fine and interesting displays at the fair, a few of which we mentioned last month, and will now refer to others which are deserving of special attention: The Brown Caloric engine is shown by the Progress Machine Works of this city. Cammeyer & Sayer, of this city, display the Rider compression pumping engine. H. S. Manning & Co., of this city, exhibit the Otto gas engine and the Hancock Inspirator; the Newburgh Engine Works, of Newburgh, N. Y., display a Whitehill engine; the Herreshoff Manufacturing Co., of Bristol, R. I., have an interesting display including their patent safety coil boilers and a new form of compound condensing engine. The Pierce Well Excavator Co., of this city, exhibit the Pierce portable hand drill and artesian well drilling and universal prospecting machine; celluloid emery wheels are shown by E. D. Bassford, of this city, and the Celluloid Emery Wheel Co., of Newark, N. J.; the Empire State Brick Co. have several of Gregg's improved brick machines on exhibition; the Fuller Electrical Co., of this city, display the Fuller light; leather belting is shown by J. B. Hoyt & Co. of this city; the Pearless Punch & Shear Co., of this city, exhibit their foot, hand and power presses; Wm. Main of Piermont, N. Y., shows a milling attachment for lathes; the Porter Manufacturing Co. display a new economizer agricultural engine; the American Vegetable Fiber Co., of Philadelphia, exhibit an improved machine for breaking and dressing hemp, flax and other plants; Col. Payne shows a large model of the apparatus to be employed in the traction of cars on the East River Bridge; a steam motor which the Third Avenue Railroad Co. have been testing for some time is exhibited in one corner of the machinery department; R. Dunbar & Son of Buffalo, N. Y., exhibit a three-piston engine; L. Katzenstein & Co., of this city, show their metallic packing, while the Pulsometer Steam Pump Co., of this city, display the Pulsometer pump.

Miscellaneous and Advertising.

The number of immigrants arriving at the port of New York for the first half of this year was 52,284, against 37,919 for the corresponding period of 1878—an increase of 14,365.

Rupture bands made to order. Single, $2.25; double, $3.50. Best material and workmanship. Send for circular. L. F. de Lesdernier & Co., 166 Greenwich street, New York.

The attention of steam users is called to the advertisement of McCabe's non-conducting covering, on first page of cover. The percentage of fuel saved by this covering makes its employment a matter of the highest importance.

E. & F. N. Spon, of 446 Broome street, New York, have just issued a catalogue, of 88 pages, of books relating to Applied Science. Intending book buyers are invited to write for one, or for any information about books. All letters are promptly answered.

For all wood and iron work near the salt water, H. W. Johns' Asbestos Liquid Paints not only form the best preservative coating, but are also from 25 to 33 per cent. more durable than the best white lead. H. W. Johns' Manufacturing Company sole manufacturers of genuine Asbestos materials, 87 Maiden Lane, New York.

Wooden beams, posts and partitions in warehouses, factories, boiler rooms, etc., are rendered as fire-proof as stone with H. W. Johns' Asbestos Concrete Coating; can easily be applied by any one with a brush, or will be applied in New York and vicinity by the manufacturers.

One inch in thickness of H. W. Johns' Asbestos Cement Felting applied to hot air and steam pipes, boilers, etc., is equal in effectiveness as a non-conductor of heat to double the quantity of any other cements or feltings. Be sure and get the genuine.

The Asbestos Roofing (with white or gray fire-proof coating) now in use in all parts of the world, is the only reliable substitute for tin. It is adapted for steep or flat roofs in all climates. It costs only half as much as tin, and can be applied by any one. Samples and descriptive price lists free.

The great advantage of the genuine Asbestos Covering for steam pipes, boilers, etc., over any other forms of non-conducting coverings, aside from their superior effectiveness and fire-proof qualities, is that they are manufactured in convenient form ready for use, and can be easily applied without the aid of skilled labor.

The Young Couple's Cottage.

BY F. T. CAMP, ARCHITECT.

This illustration commences a short series of three plans, elevations, etc., showing how a small cottage may be built—in conformity with a general design—which eventually is to be enlarged twice. First by the addition of a front hall, stairs, parlor, bath room, etc., and front chamber over parlor, retaining intact the part already up, excepting the finish exteriorly, where the juncture of the addition is made, and removing a porch. The second additions comprise a two story suite of rooms situated on the left of the hall, and comprising on the first floor a library and chamber, and on the second floor two chambers, closets, etc., retaining, as in the first instance, all that had been previously put up, except a porch or so, and adding to the existing parts a bay window, and a semi-octagonal gable.

It has been deemed appropriate to name this series "The Growth of the Cottage," the first period of which will be the present, called the "The Young Couple's Cottage," intended to accommodate a worthy, earnest, intelligent couple, presumably just starting on their way through the world together, who intend to stay in that one spot barring death, rear a family, and increase their accommodations, creating what is so rare in this country—a homestead, where all the descendants are welcome, with their dependants, as guests, at all times.

The name of the last of the series having been thus foreshadowed, it remains to allude to the second one, as the transition period between the first and the last state of that house, best named by calling it "The Family House."

Thus, in their order, will be presented, after a uniform design, avoiding the mistakes and incongruities of different generations of builders, three different phases of the same house, showing all the necessary accommodations and exterior appearances appropriate to each stage, whereby the cottage of the young couple, complete and well looking in its beginning, may be enlarged and improved, according to the demands of its occupant, still preserving a harmony of design, and avoiding a patched-up look, to the old age of the original couple, but the heyday of the house, still further amplified, by its spreading foundations and added apartments, even yet appearing as if originally erected in anticipation of just such a demand as created it.

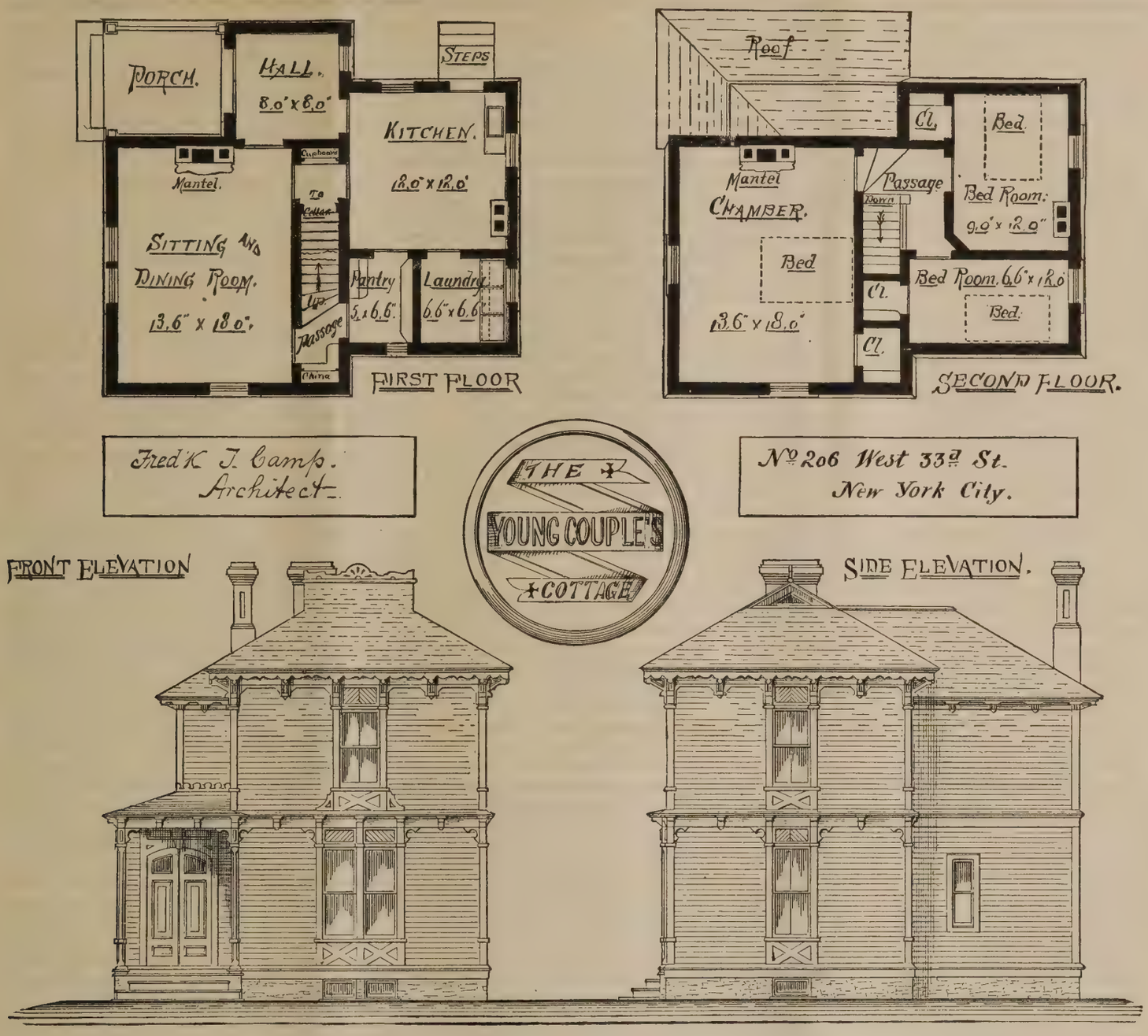
Wishing a happy beginning, a prosperous journey, and a green old age to the couple who will try it, we commend to their attention the "Young Couple's Cottage," the "Family House," and the "Homestead," illustrating "The Growth of the Cottage."

The present part is shown in wood, as it is intended to complete the series in the same material. The same plan and elevation could be constructed of brick, with unimportant modifications, with the corresponding determination to carry out the succeeding improvements in brick also.

We can furnish full working drawings, details and specifications for the same for $25. The cost of construction of the "Young Couple's Cottage" is estimated at about $1,100. Prices of the latter for the succeeding improved plans will be given at the time of their publication. Any further information regarding this or future illustrations will be obtainable from the architect, Mr. F. T. Camp, No. 206 West 33d street, New York.

SPECIFICATION.

Excavate under whole house, and also under porch. Grade dirt around finished walls, or take off the premises. Lay base course 1 foot below cellar bottom, 6 inches on each side wider



THE GROWTH OF THE COTTAGE. No. 1.—"The Young Couple's Cottage."

than net foundation wall, of large flat stone, laid across the trench. Net wall in center of base course, built to figured dimensions, of large rubble walling, laid to a line on both faces, in common brown mortar of the usual richness, pointed above grade with black mortar, made with Rosendale cement. Window sills of cut stone; also coping of chimneys, neatly chisel-cut. Foundation wall to extend under porch, making part preparation for subsequent additions contemplated in this series. Piers in cellar, also chimneys, of ordinary kiln hard-burned brick, laid in brown mortar, according to plans. Between joists over partitions to be filled with brick, to stop drafts and vermin.

Plaster.—Lath all side walls and ceilings in first and second stories with good sound lath, well nailed, and cover with one coat brown mortar well haired, one coat browning well floated and trued, and finish with coat of lime putty and calcined plaster, properly gauged, floated, trowelled, and polished. Small stucco cornices in hall and sitting-room, and neat center pieces of appropriate size in same rooms.

Carpenter-Work.—Sizes of timber as follows: Sills, doubled, 2x6 inches; studding, 2x4 inches; partition caps, doubled, 2x4 inches; braces, 2x4 inches; joists, 2x10 inches; bridging, 2x2 inches; rafters, 2x8 inches; ceiling beams, 2x6 inches—all of sound, square-edged spruce or hemlock, worked and erected in style known as "balloon" frame, thoroughly spiked and nailed. Roofs covered with gang-sawed hemlock boards, well nailed, also outside of vertical walls. Cover walls with building paper, and roofs with tarred paper. Clapboard walls with 5-inch bevel sawed pine clapboards, laid 4 inches to the weather, and slate roofs with unfading black or purple slate 10x20 inches.

Outside finish of a good quality of white pine, well seasoned. Corner boards and window and door frames of 1¼-inch; friezes, panel backs, beaded ceiling in panels, piazza posts, cresting, ornamental cut facia of cornice, etc., of ⅞-inch. Brackets built up. Water-table of 1½ inches. Cap got out of solid. Porch floor of yellow pine, over a rough hemlock floor, with tarred paper between, the yellow pine joints thickly white leaded. Porch roof covered with tin. Sash of 1½-inch white pine, well seasoned, ogee, check rail, number of lights shown on elevations, glazed with second-quality American sheet glass, bedded in soft fresh putty, hung with pulleys, weights and best hemp cord, and fastened with an approved sash lock.

Outside doors of pine, 2 inches thick. Front doors as shown, with plate glass top panels, lower panels raised molded, center panel with raised center, alike on both sides. Kitchen door four-panelled, ogee inside, and raised molded outside. These doors hung with three butts each, trimmed with good locks and catches, also bolts of brass, flush on front door. Interior doors hung with two butts to a door, trimmed with mortise locks and catches, to be 1⅛ inches thick, and all doors to have white porcelain knobs, with silver-plated roses and escutcheons.

Floorings of 1¼-inch spruce plank, not over 6 inches wide, matched, tongued and grooved, and blind nailed. Stairs, one close flight, steps housed in strings; risers, ⅞ inch; treads, 1⅛ inches; molded nosings; all of white pine; newel, 8 inches, of black walnut, square base, and turned shaft; rail plain toad-back, 2½x4 inches; balusters, 1½ inches square, turned shaft. Flight to cellar of rough stock; treads, 2 inches; risers, 1 inch; white pine, and common hand rail below floor.

Inside Finish.—Architraves in hall, sitting-room, and front room of second story, of pine, 5 inches wide, with a band mold 1x2 inches. In other rooms 5-inch plain bevelled. Bases in first-mentioned rooms 9 inches high, including 2-inch molding. Plain bevelled bases in rest of rooms, closets, etc., all of a good quality clear white pine. Windows in principal rooms panelled under, and architraves brought to the floor.

Fittings.—Cupboards in stair passage to have glass doors above and drawers below, in the usual form; shelves behind glass doors. Other shelving in pantry and over sink in kitchen—open. Closets in second story to have three shelves where marked. All shelving on beaded cleats (screwed), of good pine. Tubs in laundry of 2-inch clear pine plank, dadoed, and joints painted with thick white lead. Sink shelf of 1½-inch pine. Sink of iron, and open underneath. Clothes hooks on cleats in all closets. Two marbleized slate mantels, where shown, of the average value of $35, both fitted for fire-places. Trap-door in ceiling of second story hall, to lead to attic.

Painting.—All exterior wood-work to receive a priming and two good and sufficient coats of boiled linseed oil and white lead paint, tinted a medium brown for cornices, friezes, corner boards, etc., and a light gray for all body work. Ceiling of porch sky blue. Yellow pine oiled two coats. Sash drawn dark brown. Brackets picked out in these colors. Chimneys also painted; base and bands brown, body gray. Inside work of two shades; all stiles, rails, moldings, etc., a blue-white, and panels and body-work cream tints, in priming and two coats. Black walnut oiled and shellacked twice.

Work and material to be thorough and of good quality.

Plans and specifications are intended to coöperate so that that which is necessary to the completion of the building, according to their meaning and intent, shall be supplied and done, whether the same be specifically mentioned or drawn, or not.

The Former Owner of the Richest Mining Region.

The railroad through the cañons of Clear Creek, Colorado, brings the traveller from Garden City to Black Hawk, with its world renowned silver reduction works; from here the track ascends the side of the steep mountain by means of a zigzag course and switch-backs, until a hight of a few thousand feet above the valley of Black Hawk is reached, when the road runs direct west over a tableland on top of this part of the Rocky Mountains, until Georgetown is reached, a famous mining center. This was—when we visited Colorado last summer—the terminus of the railroad; since then it has been continued, and now reaches Leadville, situated a few thousand feet higher still, in the heart of the Rocky Mountains, and which appears to be destined to become one of the richest mining centers not only in Colorado, but in the whole United States.

The history of the ownership of this region is very interesting, as it once all belonged to one man—Mr. I. P. Whitney, (not Dr. I. P. Whitney, who is another person). Mr. Whitney lost it all, but now consoles himself by saying, as reported by an interviewer: "Although life is full of regrets, I feel but little on this score for myself, though for a company to which I sold a portion of my property, and which lost its property as I did, I do feel sorry. We must step aside and give others a chance. If I had all these properties to-day I should have been worked to death, and perhaps as uneasy and nervous as a millionaire mine-owner from Leadville whom I saw to-day. Colorado is too large to be controlled by a few men, as Nevada is. There are but few great mines in Nevada; take away the Comstock—which, with all its bonanzas, has cost more to work the whole vein than has been produced from it—and you have not a great deal left. Colorado has dozens of mines which will approach if not surpass the Comstock veins."

He stated further that notwithstanding many mines are worked very profitably, there are literally thousands of rich veins in Colorado over which the pick has not yet been swung. These mines are most always visible on the surface, yet, owing to the oxidation that covers the surface, and the obliteration of surface by rock and earth slides, they are not always in sight, and besides rich veins do not always show their wealth at third surface croppings. Sometimes the miner strikes at once a chimney or pay-streak which opens into a bonanza, but generally not.

In regard to the Leadville mines when he first saw them, Mr. Whitney made the following statement: "In the most prominent cases they looked like roads on the mountain sides; the eye could follow them for long distances. I was like Aladdin in the garden without hardly realizing it. I was quite alone in this region with my band of employed prospectors, and when I returned into this region after the assays I had made at Denver in 1865, I helped myself to three or four hundred mines, besides taking up large quantities of water-powers and tunnel sites under the territorial laws. I went from mountain to mountain, and on Fletcher Mountain, a few miles from Leadville, where I thought the mineral veins most prominent of any, I took up over 160,000 feet of mines in ten days. I took up here some mines two or three miles in length, plainly visible on the surface. In some instances the partially oxidized ores, with argentiferous galena, projected some feet above the surface rocks, and I amused myself in some instances by having the men detach large masses, weighing many tons, of glittering ore and roll them down the steep mountain side, to see their rapid flight and final disintegration. In some instances a few feet of shaft sinking would develop solid veins of argentiferous galena of from four to six feet in width. But it must be remembered that at this time there was not a railroad in Colorado, nor one within 600 miles of these mines."

Mr. Whitney can show parchment emanating from the Legislature of Colorado in 1868, recording a unanimous vote upon a series of resolutions thanking him, with the Governor's signature and the great seal of the Territory, for his personal efforts in securing the first gold medal of the World's exhibition at Paris, in 1867, for Colorado ores.

Mr. Whitney held on to these veins under the Territorial laws, which were also ratified by the action of Congress, which gave him undisputed title over 400 continuous mines, none of which were less than 1,000 feet in length. These he held by discovery, preëmption and improvement as real estate until the new mining law of the United States of 1872 came into operation, which required a continuous working of the mines or an expenditure of $100 upon each 100 feet in linear measurement, to secure a United States patent, otherwise all mines were open to new locators, and he did not think there were any left worth looking after. Notwithstanding his experiences related above, the new locators had the best of him, and he lost it all by his inertness, while a proper management could have secured him at least a valuable portion of it.

Unsafe Building Operations.

The fall of a four-story dwelling in 14th street, this city, recently, and at a time when that much-thronged street was most crowded, again calls attention to the urgent need of strong and vigilant municipal supervision over building operations in cities. This house was being converted into stores and offices, the front and an intermediate wall had been removed, leaving the floors and ceilings shored up with struts, as directed by the architect in charge. These struts were planned to support the ceilings and floors, and probably were strong enough for that purpose; the builder, without regard to this essential condition, loaded each floor with the bricks taken from the removed walls, and although in open sight for days, no one effectually protested against this public man-trap. When the building fell, several workmen were caught in the ruins—one remaining inclosed for hours before rescued; it is to the credit of no one concerned that several lives were not lost. Not only in the reconstruction of buildings is a change in this respect imperatively demanded, but frequently also in their plan and erection. In a neighboring city, a four-story structure was put up two years ago, the first floor being for commercial uses, the other three for French flats, with accommodations for more than a dozen families, and these tenements are supported by a wall on but one of the four sides of the building, the other exterior and all the division walls being on iron columns in and around the stores on the first floor. Attempt was made to let the whole of this floor to a wholesale butcher and pork dealer. The effect of a fire in such a warehouse—to cripple the iron columns, and precipitate the tenements and their inmates down to the street level—need not be described. And these two instances are not rare or exceptional here.

IRON NUTS.—It is estimated that there are in the United States over 400,000 railway cars of all kinds; also 16,000 engines. These engines and cars, in travelling over the roads, lose annually between four and five million nuts. These will weigh over 1,500,000 pounds and their cost is between $30,000 and $40,000; and this loss is continued from year to year, saying nothing of the nuts thrown into the scrap heap, with their bolts worthless from the use of the jam nut; also the liability to accident from loose nuts.

New Publications.

Ice-Making Machines. Translated from the French of M. Ledoux, Engineer of Mines. New York: D. Van Nostrand.

This little book (No. 46 of Van Nostrand's Science Series) is a reprint from a series of articles first published in *Van Nostrand's Magazine*, and treats the subject from a purely scientific view; it bears on all its pages the stamp of the thoroughly mathematical mind that wrote it, and is characteristic of French scientists, who, as a rule, reason as thoroughly and as strictly mathematically as non-scientific writers are superficial, especially when they treat upon scientific subjects. The art of refrigeration is based on strict physico-mathematical principles, especially since the discoveries of modern science respecting the convertibility of heat into motion, or inversely, the possibility of lowering temperatures by the transmission of heat by means of proper appliances. The author does the subject justice in a mathematical point of view, and continually applies algebraic formulas, with which the book abounds; many of these formulas require a knowledge of the higher branches of mathematics to understand them. For this reason we fear the book will do little good among those in this country who search for information upon the subject. Mathematical knowledge is too rarely diffused, and very few, if any, will be able to profit practically by the truths which can be deduced from the formulas.

The book treats all the different classes of refrigerating machines; first those based on compression and expansion of air, and only mentions Giffard's machine; the next class are those in which a volatile liquid is used, and among which are only mentioned sulphuric ether, sulphurous oxid, ammonia, and methylic ether; while the machines using chymogen or petroleum ether, bisulphid of carbon, and liquefied carbonic acid, which have attained some reputation in the United States, chiefly from a scientific point of view, are ignored, simply for the reason that they are not yet known in France; but as the laws are the same the formulas used for the ethers are also applicable to the first mentioned, while those for ammonia may be applied to carbonic acid, of course with the proper correction of the boiling points, which are much lower in the last mentioned liquids.

Finally, those machines are treated which are based on what is here called "chemical action," but what we would only call "solubility." As the type mentioned, Carré's first ammonia machine acts by the strong solubility of ammoniacal gas in water, and in this sense the refrigerating mixtures belong to this class, but these the author entirely omits.

The ultimate results arrived at are that, theoretically, from 1,200 to 1,500 negative caloric units may be obtained for every kilogram of coal burned, which, when reduced to Fahrenheit units and pounds, means that for every pound of coal consumed we may subtract a quantity of heat equivalent to 4,000 or 4,500 units; this is about 80 per cent above the results obtained in practice, so that only about 800 to 900 units of heat can actually be abstracted. The difference between theory and practice must be attributed to external losses of temperature, to imperfect action in the exchanges of heat, but chiefly in the expenditure of work in driving the pumps. If we consider that in the steam engine as much is lost, the ice machines, which are only in their infancy, are better than the steam engine, which has been in operation and improved upon for more than three generations.

Electric Transmission of Power. Its Present Position and Advantages. By Paget Higgs, LL.D., D.Sc. London and New York: E. & F. N. Spon.

Without the generator of dynamo-electricity the use of electric currents to move machinery, or to transmit power, would be out of the question, and has been for many years, the former sources of electricity being altogether too expensive. When, however, revolving magneto-electric machines and dynamo-electric machines were so far improved and enlarged as to require steam power to drive them, the currents obtained were strong in proportion, and equal, if not stronger, than those of the most colossal galvanic batteries formerly used for that purpose, and the use of electric currents for illuminating purposes, and for the transmission of power, became an established application.

The dream of obtaining power from electricity, indulged in by some, will never be realized; but we have the reverse—we must begin by having steam or water power, and we can transform this into its mechanical equivalent of electric currents, and, transmitting these, evolve power at distant points.

The book before us is the first treatise on the latter subject; it has been discussed over and over again in periodicals, but here we have a complete treatise, in which, first, the general principles of dynamo-electric machines are explained, and then the different machines described, such as the Gramme, Brush, Wallace, Farmer, and Siemens. After treating on the practicability of transmitting the currents thus obtained, the conclusions arrived at are, that 48 per cent of that expended in the steam engine may be reclaimed, while, under peculiar circumstances, advantages may be gained which will fully compensate for the loss.

We advise those interested to procure this little book, from which they can gather much useful information. It can be obtained at Messrs. Spon's New York house, 446 Broome street.

A Practical Treatise on Natural and Artificial Concrete. By Henry Reid. New Edition. London and 446 Broome street, New York: E. & F. N. Spon.

The author of this excellent book has already earned a favorable reputation from his work on the "Manufacture of Portland Cement," and the favorable reception of the present book since its first appearance, ten years ago, encouraged him to treat the subject more fully in the present edition.

One of the main objects of the writer is to make manufacturers of concrete sufficiently familiar with the qualities of the material from which it is made, and so do away with their principal anxiety. Another object is to teach the best methods and improved machinery used for this purpose. With this end in view, the book treats of the various materials, the methods used in manufacture, and describes the necessary ma-

chinery. The most valuable portions of the book are perhaps the statements of how various well known cements are compounded, their use in different celebrated structures, and their comparative values, as found by tests and chemical analyses. The work is illustrated with colored plates, giving a very beautiful and creditable representation of the appearance of some concretes; it also contains some sixty wood-cuts. We commend the book highly.

Correspondence.

ASTRONOMICAL CAUSES OF RAINY OR COLD SUMMERS.

To the Editor of the Manufacturer and Builder:

I would be very much indebted if you would tell me whether you have seen within the last few months, any article on the astronomical cause or causes of rainy and cold summers. If so, will you be kind enough to inform me in what American, English, German or French journals such articles can be found.

In the *Sun* of Sunday, August 24, 1879, on page 5, is an article of mine on "The Sun and the Weather," the points for which were obtained from an article published in a Russian journal, (the *Golos*). Now an editor—a friend of mine—raises the question as to the authenticity of the sources mentioned by me—the French astronomers Emile Flammarion and De Perville, and an Englishman, Henry Ray.

New York, October 16, 1879. P. Popoff, M. D.

Answer.—There can be no astronomical causes for rainy or cold summers, for the simple reason that they do not extend over the whole earth, but are merely local. If there were an astronomical cause, the effect would be general over the whole earth; but what do we actually find? Take the most recent peculiarities of the weather; while we in the United States had very dry and warm weather in October, there was in Spain an over abundance of rain and very destructive floods, by which millions of dollars' worth of property was destroyed and hundreds of persons perished; while in Austria it was very cold, and Vienna was inflicted with snow storms.

A few years ago when we had a very cold and wet summer, and some of our would-be scientists were discussing the great number of sun spots as a cause, we called attention to the fact that, according to reports from Europe, the weather there was very hot and crops suffering from want of rain. We hold that the total amount of evaporation and rainfall averaging over the whole surface of the earth, is very nearly a constant quantity, and that sun spots do not diminish solar radiation, and if they did, they would diminish the evaporation, and consequently the rain-fall, instead of increasing it, because all the water that descends must have first ascended by solar heat, and what has been taken up will come down somewhere. If now, by a series of circumstances, some part of the earth's surface gets more than its usual share at the the expense of another part, people commence at once to reason about astronomical causes, without first investigating whether the whole earth suffers in the same way. There is an important fact which proves that if much rain falls in one region, it must be carried there from other regions where the weather is clear and an amount of evaporation takes place adequate to supply that excessive rain; this fact is, that if the total amount of watery vapor which the atmosphere can hold were to descend at once over the whole terrestrial surface, it would only amount to 4 inches, and raise the surface of the ocean as much; but as one-fourth is land, from which it would flow to the ocean, it would cause the ocean to raise its level about 5 inches.

By the way, how about the flood? Was all that water created for the occasion, and annihilated again after the event? This is a nut for theologians to crack.

SILICIOUS DEPOSIT IN WELL-WATER.

To the Editor of the Manufacturer and Builder:

I had a well dug lately, and found water in a dark colored slate rock. I draw the water into a trough through a ½-inch lead pipe, about 700 feet long. There is a brick-red colored stuff (of which I enclose a sample) constantly being formed in and discharged from the pipe. It sometimes chokes up the pipe so as to require the use of a pump to clear it. When discharged from the pipe it has the general appearance, except in color, of large, light snow flakes, and is so nearly the gravity of the water that it is slow in settling to the bottom. I do not find it in the well or in the trough, except as it comes from the pipe.

I suppose it to be mineral, but am only guessing at it, and, unless an analysis would cause you trouble or expense, would like to learn from you the precise nature of it. I would also like to know the reason why (if mineral) it is thrown out and separated from the water only in the pipe, and is not precipitated in the well or trough. I can understand why lime or other substances are left in a steam boiler, but in the case of this pipe, where there can be no evaporation, it is incomprehensible to me. Is there a remedy for the choking of the pipe?

Yours, very respectfully, E. P. Thorn.

Youngstown, Ohio, September 22, 1879.

Answer.—The colored stuff you send is simply a silicious mineral, colored red by oxid of iron, and evidently pumped up with the water from the bottom of the well. We think that if you were to raise the end of the pipe in the well, so as not to draw the bottom water or agitate it, or the bottom mud, you would not get so much of that material into the pipe. That it does not reach the trough is probably caused by the great length of the pipe. The above will show you that it has nothing to do with steam boiler scale, nor evaporation, and that there is nothing incomprehensible about it, only you have overlooked the condition of the cracks in the dark colored slate rock at the bottom of your well, and through which the water comes up.

Notes and Queries.

This department is intended to furnish, for the benefit of all our readers, information on any subject of scientific or practical knowledge falling within the field of The Manufacturer and Builder. *All persons possessing additional or more correct information than that which we give relating to the questions, are cordially invited to communicate it to us for publication. We also request that all questions or answers be written on separate pieces of paper, and addressed to the Editor.*

QUESTIONS.

(2505) The East River Bridge.—I have not heard anything lately about the East River bridge between New York and Brooklyn. Are they at work on it? Is the work dragging along? How long has it now been under way? Will it ever be finished? Answers to these questions, and any other details in connection with this great undertaking, will be thankfully received.—A Subscriber, Adelaide, South Australia.

(2506) Fire-Proof Timber.—Can you give a method for making timber fire-proof—I mean such timber as is used in mines to support the roofs of tunnels, etc.?—D. S. S., Denver, Colo.

(2507) Cement for Belting.—Is there anything better for cementing belts than fish glue? If so, what?—E. P. M., New Boston, N. H.

(2508) New Coal Mines in France.—Can you give any information in regard to the new coal mines said to have been discovered some 25 years ago in France? I have not heard of them since. Where are they situated? and what do they amount to?—T. S., Roselle, N. J.

(2509) Number of Bessemer Works.—How many Bessemer works are there now in this country? where are they located? what is their capacity of production? and what are the prospects of this business?—R. F., Santa Rosa, Cal.

(2510) New Zealand.—I intend to immigrate to New Zealand. What is your opinion about the prospects in that new country?—An Englishman, New York City.

(2511) Testing Portland Cement.—How can I determine whether Portland cement is good—in fact, if the stuff sold as such is real, reliable Portland cement?—W. L., Swanville, Me.

(2512) Soluble Prussian Blue.—What is soluble Prussian blue? What is it used for? How can I make it?—M. A., Tiltonsville, Ohio.

(2513) Fading Ink.—I am informed there is an ink very popular in Paris, called "Ladies' Ink," which fades away in a few weeks. I should like very much to know how it is made. If you can tell, you will oblige.—A Lady Reader, Brooklyn, N. Y.

(2514) Can Ice Boats go Faster than the Wind?—I saw in the *Evening Post*, of October 17th, a controversy in regard to the velocity of ice boats, the question being whether they can move faster than the wind. It appears that the editor of that paper had answered the question negatively, on the ground that it is impossible to create force out of nothing, and that if an ice boat moved faster than the wind which drives it, the excess of the velocity of the boat over the wind would be created out of nothing. The objections made to this opinion by several correspondents, induced the editor of the *Evening Post* to ask for a definite decision respecting this matter from Professors Barnard and Loomis. These learned gentlemen answer that the editor of the *Evening Post* is right, and that an ice boat cannot go faster than the wind, except when the wind suddenly slackens, when the momentum of the boat might for a very short time cause the boat to outrun the wind. Now, I remember that some ten years ago there was a controversy in regard to this same subject, and that you held that the ice boat could go faster than the wind; you defended this view publicly, as well in various numbers of the *Scientific American* as in your own journal. Now, I would like to know what you have to say against such authorities as the eminent professors named, and whether you have changed your mind respecting it. I find your opinion referred to on page 72 of your March number for 1871, in reply to Query 76, where you distinctly say that, with a wind of say a velocity of 40 miles an hour, an ice boat may make 60 miles an hour. Please give a definite answer, and if you still hold the same opinion, produce your proofs.—G. L. T., New York City.

(2515) Molding Preparation for Dentists.—Will you be kind enough to inform me how to make a good molding preparation for dental purposes. I would like something that is pliable and will work easy when warm, and on cooling be firm and hard.—W. T. B., New York City.

(2516) Cementing Animal Membranes.—In answer to Query 2486, in your October number, you give a recipe for uniting leather, but as what I wish to unite, and of which I enclose a sample, is not exactly what might be called leather, you will perceive that it cannot be united by the process given, nor with rivets.—P. L., Montreal, Canada.

(2517) Silvering and Gilding Zinc.—I find it rather difficult to silver and gild zinc. Can you suggest anything that will help me?—D. T., Troy, N. Y.

(2518) Covering Zinc with Colored Coatings.—I have seen zinc articles brilliantly colored with thin films of what proved to be copper. Please inform me how this is done.—D. T., Troy, N. Y.

(2519) Electric Anti-Incrustates.—On page 196 of your September number, I see you make some sharp hits in regard to a certain Philadelphia M. D., whom you designate by the expression "of electric anti-incrustation humbug notoriety." I wish some explanation as to why you express yourself in such a way, as I find that you have also taken out a patent for an electric anti-incrustator.—A Shareholder in the (Bursted) Porter Patent Anti-Incrustator Co., Philadelphia, Pa.

(2520) Copygraph, Chromograph, or Lithogram.—Can you inform me whether the Copygraph is patented, as claimed by some parties. What is the pad made of? Can you tell me how to make it, and also the ink?—S. R., Hartford, Conn.

(2521) Antidote for Nitro-Glycerin and Strychnin.—What is the antidote for the poisonous nitro-glycerin?—R. M., Evansville, Ind.

[Some persons have expressed doubt in regard to the large number of questions asked us, and appear to be suspicious that we make them up ourselves. As proof we here copy literally from a postal card just received. We number the questions additionally, 1, 2, 3, etc.]

(2522) [1] Choice of a Trade.—What trade would you recommend a young man to learn?—W. H. G., Newton, Mass.

(2523) [2] Extracting India Ink.—Can you tell me how to extract or erase India ink from the skin?—W. H. G., Newton, Mass.

(2524) [3] Cheap Dentifrice.—What is a cheap dentifrice?—W. H. G., Newton, Mass.

(2525) [4] Effect of Salt on the Teeth.—Is salt injurious to the teeth?—W. H. G., Newton, Mass.

(2526) [5] Theory of Evolution.—What is meant by the theory of evolution?—W. H. G., Newton, Mass.

(2527) [6] Electricity in Hair.—My hair is very dry, and when being combed cracks as though it were full of electricity. Is this supposition correct? How can I prevent it?—W. H. G., Newton, Mass.

(2528) [7] Cooling the Head.—What would you recommend as a cooling remedy for the head?—W. H. G., Newton, Mass.

(2529) [8] Strength of Hollow and Solid Columns.—Which will support the greater weight, a solid pillar or a hollow one of the same diameter?—W. H. G., Newton, Mass.

REPLIES.

(2505) The East River Bridge.—The work is now going on with vigor, 800 men being employed at a cost of $8,400 per week for wages to workmen and $1,000 more for officers and engineers. In a short time the number of workmen will be increased to 1,000 for the tearing down of several more blocks of buildings to make room for the approaches in New York and Brooklyn. The towers were finished long ago; so were the cables, and the construction of the floor, with the many rods suspending it, will finish the bridge proper. This part of the work, however, is not being hurried, as it would be of no use until the approaches are ready, on which now, in New York and Brooklyn, by far the greater number of the men are engaged. In regard to other information, we can do no better than give here a copy of a card printed by the directors in answer to the many inquiries made of them in regard to this remarkable structure. The card says: "Construction commenced January 2, 1870; size of New York caisson, 172×102 feet; size of Brooklyn caisson, 168×102 feet; timber and iron in caisson, 5,253 cubic yards; concrete in well holes, chambers, etc., 5,669 cubic feet; weight of New York caisson, about 7,000 tons; weight of concrete filling, about 8,000 tons; New York tower contains 46,945 cubic yards of masonry; Brooklyn tower contains 38,214 cubic yards of masonry; length of river span, 1,595 feet 6 inches; length of each land span, 930 feet—1,860 feet; length of Brooklyn approach, 971 feet; length of New York approach, 1,562 feet 6 inches; total length of bridge, 5,989 feet; width of bridge, 85 feet; number of cables, 4; diameter of each cable, 15¾ inches; first wire was run out May 20, 1877; cable making really commenced June 11, 1877; length of each single wire in cables, 3,578 feet 6 inches; ultimate strength of each cable, 12,200 tons; weight of wire, 12 feet per pound; each cable contains 5,296 parallel (not twisted) galvanized steel, oil-coated wires, closely wrapped to a solid cylinder 15¾ inches in diameter; depth of Brooklyn tower foundation below high water, 45 feet; depth of New York tower foundation below high water, 78 feet; size of towers at high water line, 140×59 feet; size of towers at roof course, 136×53 feet; total hight of towers above high water, 278 feet; clear hight of bridge in center of river span above high water, at 90 degrees Fah., 135 feet; hight of floor at towers above high water, 119 feet 3 inches; grade of roadway, 3¼ feet in 100 feet; hight of towers above roadway, 159 feet; size of anchorages at base, 129×119 feet; size of anchorages at top, 117×104 feet; hight of anchorages, 88 feet front and 85 feet rear; weight of each anchor plate, 23 tons; total cost of bridge, exclusive of land $9,000,000. The bridge will probably be completed in 1880. Engineer, Col. W. A. Roebling."

(2506) Fire-Proof Timber.—Perhaps the method of Mr. D. R. Gardner, a Glasgow engineer, is the best—at least it is said

to be effective, and is certainly effective against decay and the attack of worms or insects. He dissolves and removes the sap by placing the timber in a tank and subjecting it to the action of vapor, continuously or intermittently, from 6 to 84 hours. He preferably begins with a neutral vapor, then alkaline vapor, and then again a neutral vapor consisting of the fumes of mercury; the time may be 24 hours for each of the first three steps, and 12 hours for the last, which should be the fumes of mercury, if for preservation. The alkali and acid may be applied by being put into the boiler, or otherwise, and the vapors can be tested with litmus paper, as to their neutral alkaline or acid state. The mercurial fumes are created by mixing equal quantities (by weight) of mercury and nitric acid, and allowing them to escape in the tank.

(2507) Cement for Belting.—We refer you to our answers to Queries 2009 and 2486, on pages 24 of our January number for 1878 and 239 of our October number for 1879. Fish glue is not reliable, as it is apt to crack. A solution of gutta percha in bisulphid of carbon is better, as it is water-proof. The only perfectly reliable connection is lacing or riveting.

(2508) New Coal Mines in France.—France cannot boast of having much coal, hence the new mines discovered in 1851 were of great importance to that country. They are situated near the British channel, what the French call the "Pas de Calais," as this is also the name of the department where the coal was found. The production has steadily increased during the last five years, at the rate of 10 per cent per year on an average, and now amounts to a little over a million tons, which is more than one quarter of the whole coal production of that country, the whole amount being scarcely four million tons per year.

(2509) Number of Bessemer Works.—In an article entitled "Bessemer Steel vs. Iron," on page 199 of our September number, we have already stated that there are 11 Bessemer works in the United States. They are near Troy, N. Y., about 14 years in operation; near Harrisburg, Pa., 12 years in operation; in Cleveland, O., 11 years; at Johnstown. Pa., 8 years; Chicago, Ill., 8 years; North Chicago, 7 years; Joliet, Ill., 6 years; Bethlehem, Pa., 6 years; Pittsburgh, Pa., 4 years; Scranton, Pa., 4 years; St. Louis, Mo., 3 years. The capacity of all these works is about the same; most of them have two converters, of 6 tons each, (2,240 pounds to the ton). Some have converters of 7 tons, such as those at Troy, Bethlehem, Pittsburgh, and St. Louis, while a few others have 5-ton converters, such as those at Scranton and Johnstown. The amount of production varies, however, depending upon the system of labor followed. If this is well organized it will double the capacity; thus the works at Troy are able to produce 78,600 pounds of Bessemer steel in 24 hours, an amount which they have occasionally reached, but which we believe has never been reached by any works of equal capacity in the world. The prospects of the business are daily growing more favorable, and it appears that the prediction which an iron master made to us in 1864 is to be realized. He said the time was coming when Bessemer steel would take the place of cast and wrought iron in most all cases where it was possible to use it instead.

(2510) New Zealand.—It is difficult to give reliable advice about any country, old or new. Success depends as much on ourselves as on the country to which we go; some people cannot succeed even in the best countries; but one thing is certain, nobody can succeed in a bad country. New Zealand, however, appears to be exceptionally good, as it was only settled forty years ago, and has already half a million inhabitants, and a good class of people at that. It has a trade with the United States of more than $10,000,000 a year, more than 1,000 miles of railroads, and 7,000 miles of telegraph wires. The area is more than 100,000 square miles, therefore larger than England, Scotland, and Ireland together. Its climate is about like that of England, only more equable; it is rich in a variety of minerals, but not yet developed. So you see that on the whole nothing but good can be said about that country.

(2511) Testing Portland Cement.—Weigh a cubic foot of dry cement. If good it should weigh from 80 to 100 pounds. The color should be a warm, bluish gray; it should be quite dry, and free from all lumpiness or tendency to caking. When you take up a handful and squeeze it, it should feel soft and silky, and be free from grit; it should not cake in the hand when squeezed. These are the best tests, next to using it. Of course the most reliable test of all, is like that of the traditional pudding.

(2512) Soluble Prussian Blue.—It is nothing but a solution of ordinary Prussian blue in water containing a solution of oxalic acid, which makes the Prussian blue soluble, while it is insoluble in pure water. It is used for laundry purposes, and as a blue ink.

(2513) Fading Ink.—If the inquirer were a business man, who we thought might use the secret for signing bonds, notes, and similar documents, we would not impart it to him; but as in this case it is a lady, we will communicate the secret, as she no doubt only wishes to learn it for her exclusive benefit in love correspondence, and does not wish her letters to be lasting mementoes of her momentary passion, which may disappear in a month. Well, our prescription is for an ink that will last scarcely that time. *Secret Prescription.*—Boil starch, and thin it until it will flow well out of a pen; then drop in a solution of iodin in alcohol, until it is dark enough to write with. It produces a blue writing, which will disappear quickly when it is kept warm, by the evaporation of the volatile iodin which gives it the color. It will disappear anyhow in about four weeks, which is about as long as love usually lasts among fickle women, and it is no more than right that the ink should fade when love fades.

(2514) Can Ice Boats go Faster than the Wind?—We hold the same opinion as before, because it is based on practical experience as well as on theoretical considerations. That Professors Barnard and Loomis did not coincide with our view, is because they have only looked into the matter superficially—only considering the case where the ice boat runs directly before the wind, in which case it cannot of course go as fast as the wind. A wind of say 40 miles an hour cannot make a boat go before the wind as fast as that, because in that case there would be no more pressure on the sails, and no force to drive it; but if the boat sails with the wind a-beam, matters are entirely changed, and this is what the professors named overlooked altogether. Now, the fact is that ice boats are sailed by pressure, with the wind a-beam, and all ice yatchmen know that in that direction their boats sail much faster than before the wind. This is so evident, that if an ice boat, after sailing during a stiff breeze with the wind a-beam, is suddenly turned before the wind, it will run ahead of the wind, as proved by the behavior of the sails and flags, as these are blown backward. In fact, this question has long since been settled as well as any disputed question possibly can be. *Note.*—Since writing the above we see that Profs. Barnard and Loomis have publicly retracted their opinions, and confessed that they had not considered the matter sufficiently. So there are none left to deny that ice boats can sail faster than the wind.

(2515) Molding Preparation for Dentists.—We believe that the mixture of wax and rosin which dentists use for taking molds in the mouth, is as good as anything that could be desired; it is pliable, works easy when warm, and when cool is firm enough to make plaster casts in. Easily fusible metallic alloys have not cohesion enough; they are hard when thoroughly cold, but are brittle when just changing from the fused to the solid condition.

(2516) Cementing Animal Membranes.—The sample sent is a thin animal membrane, similar to a piece of bladder. It is not greasy, and we believe that good glue, dried under strong pressure, might unite it and make a strong joint, providing the joint is not subject to much bending, as the material, notwithstand being quite thin, is rigid and unelastic.

(2517) Silvering and Gilding Zinc.—A direct silvering of zinc is not practicable, for although the zinc covers itself speedily and nicely with silver, as well as with gold, yet this coating becomes dull and unseemly after a short time. It has been found best to plate the zinc first with brass or copper. It not being sufficient, however, to merely cover the zinc by simple immersion, it is necessary to produce a good, durable precipitate, which can be accomplished by using the galvanic battery and a solution containing cyanid of potassium. A process has of late been published in Germany to copper-plate zinc articles by simply suspending them on zinc wires in a solution of blue vitriol and caustic potash, which, to prevent a precipitate being thrown down, is mixed with tartaric acid or glycerin. Articles made of sheet zinc are better adapted for plating with brass than cast zinc, because the latter, if not most carefully handled, are liable to be disfigured with black spots.

(2518) Covering Zinc with Colored Coatings.—The articles of zinc are first brightened by vigorous scouring with quartz sand, moistened with dilute muriatic acid, putting them quickly in water, and then wiping dry most carefully with white blotting paper. To insure success, however, it is necessary to employ zinc as free as possible from lead, and to have it as bright as a mirror. When these conditions are fulfilled, the metal may be coated with a variety of the most beautiful colors by immersion in a solution of alkaline tartrate of copper for a shorter or longer interval of time, depending on the color desired. The solution is made by dissolving 3 parts of air-dried tartrate of copper in caustic soda lye, containing 4 parts of hydrate of soda to 48 parts of water. If the zinc is dipped in this liquid at a temperature of 10° Cels. (=50° Fah.), it becomes violet after two minutes, takes a dark brown in three minutes, changes to green in four and a half, to golden yellow in six and a half, and to purple in eight and a half minutes. If the liquid be employed at another temperature than that given above, the appearance of the different colors will also vary in other short periods of time. If the zinc be left longer than eight and a half minutes in the copper liquid at 50° F., the last mentioned purple color disappears, being replaced by one or another of the preceding hues, depending on the time; but then they are never of the same brilliancy, and will continually diminish, until after some days' immersion the zinc is covered with a miscolored suboxid of copper. For this reason the articles are removed from the bath as soon as the desired color is fairly developed, and rinsed immediately in water. After careful drying, the metal must be coated with a good varnish, to make the colors more durable.

(2519) Electric Anti-Incrustates.—We gladly answer the criticism, which would be deserved if it had been our intention to make money out of a patent, which, notwithstanding it was based on sound scientific principles, did not in practice give the results which we were justified in anticipating, while we trusted in the truth of the testimonials produced by those interested in the Porter patent. One thing is certain, namely, that our patent was founded on correct principles, strengthened by careful experiments. However, when we applied it on a large scale in steam boilers, and found by unprejudiced observation that the results anticipated were not realized, we abandoned further pursuit, with the consciousness that we had been honest, as nobody had lost a single cent in it except ourselves.

(2520) Copygraph, Chromograph, or Lithogram.—By the laws of the United States, no party can procure a patent unless he swears that he is the original inventor. The right to a patent from this source has long been invalidated on account of the neglect of the original European inventor of the Copygraph to apply within the time specified by the United States laws. The original inventor was Ferdinand Stein, of Vienna, who for the last six years has been selling the recipe as a secret to various parties. The Lithogram sold by Jacobs, of Canada, is nearly the same thing. The compound used by Stein was analyzed by Dr. V. Wartha, who imitated it, and has published the recipe of his imitation in "Dingler's Polytechic Journal." The principal ingredients are glue and glycerin, the same as some printers' rollers are now made of, to which some dextrin and heavy spar are added. The following is the recipe: Best gelatin or glue, 1 part, soaked over night in cold water and the excess of water poured off; the glue is then warmed in a water bath with from 10 to 12 parts of glycerin, to which is added 4 to 6 parts of freshly precipitated sulphate of baryta and 1 part of dextrin, well mixed with constant stirring. During the summer less glycerin should be added than in winter, as the glycerin softens the mixture, while the glue and dextrin harden it. While soft it is poured into a zinc box and cooled. For ink, the anilin ink called Violet de Paris, is best.

(2521) Antidote for Nitro-Glycerin and Strychnin.—Strong coffee is the recognized antidote for nitro-glycerin, while Dr. Lelli has found it to be an equally sure antidote for strychnin.

(2522) [1] Choice of a Trade.—This depends entirely upon the young man: First, what he would like best; second, what he is fit for; third, it also depends upon the country in which he lives; and, fourth, upon the amount of money his parents or guardians can afford to spend for him. It would not do for us to recommend any certain trade, because, suppose all the young men who read the Manufacturer and Builder, should follow our advice, what would become of them? Undertaking is a very good business; but suppose we were to advise all young men to become undertakers, and they all followed our advice, we might have six undertakers for every dead man. We use this ridiculous illustration to show the absurdity of the question.

(2523) [2] Extracting India Ink.—It is very difficult, and often impossible, to extract carbon when it is deeply imbedded beneath the skin, as is the case with gunpowder when driven into the pores by an explosion. The colors inserted by tattooing also remain during life. When the India ink, gunpowder, or charcoal dust is only in the epiderm, it will in the course of time wear off; but when it has penetrated into the true skin under the epiderm, it is fixed, and can never be obliterated. Chemists, whose hands often become blackened by carbon or charcoal dust, oil their hands and then wash with soap and water. This is about the best and only way to remove carbon, in case it is possible to remove it. The oil softens the skin and affords a chance for the carbon to leave the pores, especially if a stiff brush is used when washing.

(2524) [3] Cheap Dentifrice.—Of the many cheap dentifrices, fine charcoal is the best.

(2525) [4] Effect of Salt on the Teeth.—If you mean common table salt, we answer, No; if you mean salt in general, we answer that it depends on the kind of salt.

(2526) [5] Theory of Evolution.—The theory of evolution means that the different species of plants and animals have evolved one from the other; that at first very simple plants and a low grade of animals existed, and that they not only improved from generation to generation, but that new kinds developed from pre-existing kinds; that life began with ferns, simple aquatic plants, and shell fish; from these came more complex plants and snails, and ultimately all animals. Those who are the most ultra evolutionists, include man in this series, and say that it stops here, as there is no link from man to the angels. But this is the very and only evolution in which orthodox people believe—they hold that angels are evolved from dead men.

(2527) [6] Electricity in Hair.—Some people's hair is like the fur of a cat, which, when rubbed in dry weather crackles. Let it crackle; there is no harm in it.

(2528) [7] Cooling the Head.—Bay rum has a great reputation for this, and no doubt deserves it; but we believe that cold water is as good a remedy for the head as any, whether in the form of a shower bath or applied by a towel. In some forms of disease, so strong a cooling remedy as ice is beneficial; but this should never be applied except under the direction of a physician who watches the patient, because if applied when not needed, or if applied too long, it may act very injuriously.

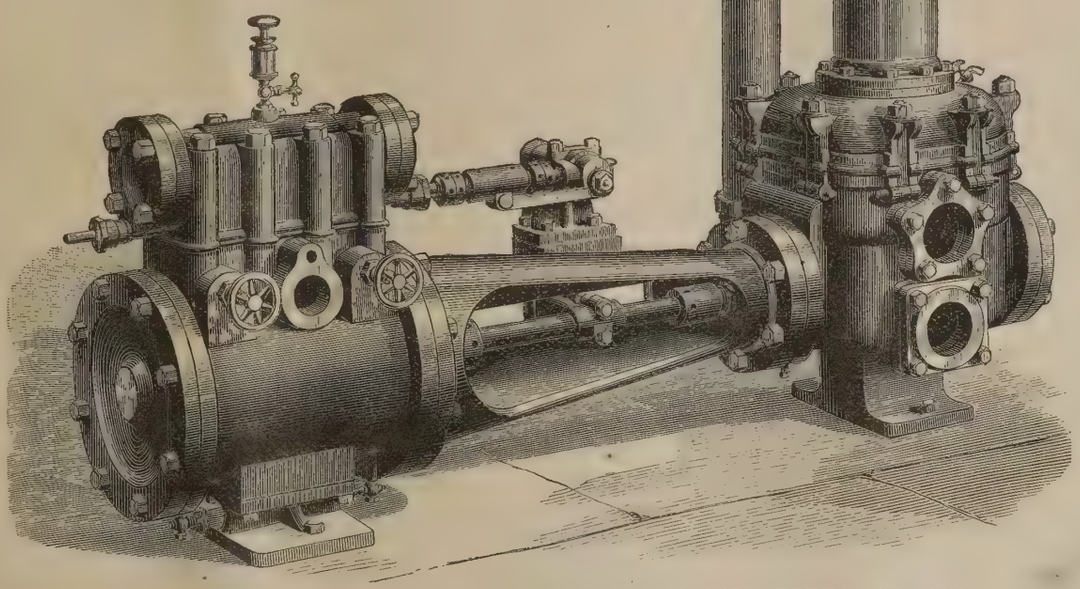
(2529) [8] Strength of Solid and Hollow Columns.—A solid column is the strongest. When the center is bored out, there is not much difference in the strength as long as the hollow is small; but when the diameter of the hollow is increased the column weakens, and becomes very weak when there is only a thin shell left. If you had asked which will support the greater weight when the columns are of the same weight, then we would say the hollow column, as it has the greatest diameter, provided the diameter is not so very large as to have only a shell left as thin as paper. There is of course a limit to everything, and within reasonable limits a hollow column is always the strongest, therefore iron columns are always cast hollow.

THE MANUFACTURER AND BUILDER.

Vol. XI.—No. 12. DECEMBER, 1879. ELEVENTH YEAR.

Noiseless Direct-Acting Steam Pump, for Water Elevators, etc.

The George F. Blake Manufacturing Co., who have their office at 86 and 88 Liberty street, New York, never satisfied so long as there is anything left to improve in their excellent steam pumps, by which they have earned a well deserved reputation, have recently introduced the new style of pump represented in the adjoined engraving, which is especially designed for use in hotels, hospitals, and public buildings for working water elevators, or to do general pumping. It has two chambers, one seen at the right for air pressure, and the smaller one at the left for suction; these two chambers being sufficiently large, contribute a great deal to moderate the pulsation at the end of each stroke. But another much more important device has been added for the same purpose, which accomplishes it perfectly, and is the result of studying out the causes of the jar experienced at each end of the stroke of a pump acting without a fly-wheel. The latter is an admirable device for obtaining, by the action of its crank upon the piston rod, a gradual diminution of the velocity of the stroke toward each end of the cylinder; but it has the great disadvantage of having a dead center, resulting sometimes in the fatal inconvenience that when the pump is stopped on that center, nothing but turning the wheel by hand can start the engine. Without the fly-wheel and crank, the piston, moving with the same speed through the whole length of its stroke, comes at each termination to a full stop, and starts almost as suddenly in an opposite direction; and the water elevated by the pump has its momentum stopped and its motion started just as suddenly. This is the cause of the jar at every stroke, which in most pumps of this class is very objectionable.



NOISELESS DIRECT-ACTING STEAM PUMP, FOR WATER ELEVATORS, ETC.

This irregular action upon the water has been corrected by the duplex pump, in which one piston is at half stroke when the other is at the end of it. Such a pump, also made by the above company, we have described on a former occasion; but the pump which we now describe, is the result of an attempt to obtain the same advantage as in the duplex, by means of one water cylinder—of course double-acting.

This has been accomplished in the pump here represented by means of a very perfect and novel arrangement in the steam cylinder, which can be regulated at will.

The engraving scarcely needs any further explanation, except to say that the sliding valve is operated by a noiseless lever, moved by an attachment to the piston rod, as shown. In other respects this pump has the same good points which distinguish all the pumps manufactured by this company.

Using Steam at Reduced Pressure.

The question in regard to the economy of raising steam at a higher temperature and using it at a lower one, is one of great interest as to the economy of steam. As it is claimed by the manufacturers of some pressure reducers and regulators that there is a great advantage in it, and that consequently the use of their reducers of pressure results in economy of steam, it is worth while to consider this claim, as promised on page 242 of our last number.

The data which we will enumerate are based on the results of the experiments of Regnault, who has determined them in the most rigorous manner. They are as follows: Water converted into steam of 212° Fah. will increase its volume 1,788 times, exert a pressure of 15 pounds per square inch, and require for this conversion 1,000 units of heat. Water converted into steam at 250° under a pressure of two atmospheres, or 30 pounds, increases its volume 900 times, and might be expected to require 250—212, or 38 units more heat, (remembering that a unit of heat is 1° Fah. of heat added per pound of water). Experiments show, however, that it requires only 11 more heat units, because the specific heat of steam is scarcely one-third that of water, (also remembering here that the specific heat means the amount required to heat 1 pound of any substance compared with water as unit).

If water is converted into steam at 293° under a pressure of 4 atmospheres, or 60 pounds, it will have increased its volume 475 times, and not require 293—250, or 43 more units of heat, but only 12½ units. Water converted into steam at a temperature of 340°, under a corresponding pressure of 8 atmospheres, or 120 pounds to the square inch, will not require 340—293, or 47 more units of heat, but only an addition of 14 units for 4 atmospheres increased pressure.

It will thus be seen that for every additional atmospheric pressure an amount of heat is added, growing less and less, and this for the reason that the capacity of steam for heat decreases when the temperature increases, which, in plainer words, means that the successive addition of the same amounts of heat has more effect, and produces a greater increase of temperature and corresponding pressure, if added to steam of a higher temperature, than if it is added to steam of a lower temperature.

We will now illustrate this by an example. Suppose we have a cylinder of some 40 cubic feet capacity, with a balanced and well fitting piston; suppose further we have 1 pound of water, or 27 cubic inches, in this cylinder, and convert it into steam of 212°, it will become 27 cubic feet of steam, and lift the balanced piston against the atmospheric pressure, with a force equal to that pressure—that is, 15 pounds per square inch. The distance the piston moves through will of course be in the inverse ratio of its acting surface; but in any case an increase of 27 cubic inches of water, into 27 cubic feet, or 46,656 cubic inches of steam, will produce an effect on the piston equal to $46,656 \times 15 = 699,840$ inch-pounds, or $699,840 : 12 = 58,320$ foot-pounds, which will be so many units of power, if performed in one minute.

Let us now see what amount of power we obtain when we heat the water to a higher temperature, and thus work at a higher pressure than the common atmosphere. It has been shown that when we heat the water to 250° Fah., we obtain double the atmospheric pressure. Our piston would then be lifted by a force of 30 pounds, while the volume increases 900 times. The number of inch-pounds will then be equal to $27 \times 30 \times 900 = 729,000$, and dividing by 12, we obtain 60,750 foot-pounds for 1,011 units of heat.

When we heat water to 293° Fah. we obtain four

times the initial atmospheric pressure, $4 \times 27 \times 15$ pounds, or 1,620 pounds, and as the water in this case expands only 475 times its original bulk, it will be equal to 64,800 foot-pounds for 1,022 units of heat.

Finally, when we heat the water under pressure to 340° Fah., it will expand into steam 250 times the bulk of the water. Its pressure will be 8 atmospheres, or $8 \times 15 \times 27$ pounds, or 3,240 pounds; this gives 68,040 foot-pounds for 1,038 units of heat.

The economy of raising steam to a higher temperature and pressure is evident from the above; of course this has to be done within reasonable limits, but the practice of the compound steam engine and of the cut-off is based on this principle. In these cases the principal advantage is derived from the cooling of the steam by its expansion, so that it leaves the cylinder at a lower temperature than it does when not used expansively, or not used in a compound engine. It is evident that there is a direct economy of heat when the heat blown off by this waste steam, or which in a condensing engine is communicated to the water of condensation, is not wasted in this way, but serviceable in the driving of the engine.

The question may now arise: If we raise steam at a higher temperature and pressure, and reduce it to a lower pressure by means of a pressure regulator, do we not lose heat by this reduction without contributing to the driving power of the engine? This objection appears well founded at first sight, but it should be remembered that when steam expands without resistance to its expansion—that is, without doing work, its temperature is by no means lowered to that extent as is the case when it expands under resistance and while doing work, as in engines to which a cut-off is applied.

This law is forcibly illustrated by those refrigerating and ice-making machines working by the expansion of compressed air. When this compressed air is simply expanded by blowing it off into a refrigerator, scarcely any descent of temperature is produced; but when it is passed through an engine, and caused to do work, the cooling will be in proportion to the work done, as we have a conversion of heat into work when using compressed air at 60° as well as when using steam at 260°; in the latter case 60° of heat may be consumed for the production of power, and the steam will be reduced to 200°, while in the former case 60° of heat possessed by the air will be consumed for the same purpose, and reduces the temperature to 0°. In fact, the engine in which the latter operation is performed, soon becomes covered with frost, and this in greater proportion as its motion meets with greater exterior resistance. It is very interesting to observe in such machines how the descent of temperature of the escaping air is in direct relation to the ascent of temperature produced in the fly-wheel by a friction brake, if the resistance is applied.

It is thus clear that if we raise steam at higher pressure, and reduce this pressure in a regulator without making it do any work, we will not reduce its temperature to any effective degree, but gain all the advantages explained in regard to the economy of fuel when heating steam at higher temperatures.

Directing Letters.

On the authority of a contemporary, we stated, in an article on misdirected letters in our November number, that there is only one New York in the United States. We are compelled to correct this by the statement that there are four New York post offices besides that of metropolitan New York, namely, New York, Wayne county, Ohio; New York, Henderson county, Tex.; New York Mills, Oneida county, N. Y.; and New York Mills, Otter Tail county, Minn. As the other New Yorks are all very small places, the chances are more than a thousand to one that a letter to "New York" is intended for New York, N. Y., and not for the Ohio or Texas New York; so that postmasters are pretty safe in forwarding all such letters to New York, N. Y.

The Manufacturer and Builder.

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This journal has the largest circulation of any mechanical monthly published in the United States. Its value as an advertising medium is therefore apparent.

Vol. XI. No. 12. ELEVENTH YEAR.

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Renewal of Subscriptions.

A large number of subscriptions to the MANUFACTURER AND BUILDER expiring with the present number, we would request that subscribers send in their renewals promptly, so as to avoid any delay attendant upon receiving the following issues.

Special Notice to Agents.

There seems to be a misapprehension existing among agents regarding the offer made by us last month to send the November and December numbers to subscribers for 1880. We wish to state that this inducement is intended only for those sending $2, and that we cannot undertake to supply the orders of subscription agents on this basis; they must in all cases send the pro rata amount when ordering these two additional numbers.

Steam Heating as Applied to Cities.

In regard to the data followed by professional parties who make the manufacture of steam-heating apparatus a business, and to which we referred at the close of our article under the above head, on page 243 of our November number, we will now state as follows:

Experience has proved that for every 500 cubic feet of space to be heated, 1 square foot of heating surface in a steam boiler, running from 5 to 10 pounds of steam, is required, if we want to raise the temperature 50° above that of the air surrounding a house. This is a mean estimate. If a building is favorably situated, every square foot of boiler surface may be capable of heating 600 or 700 cubic feet; if, on the contrary, the building is unfavorably situated—that means, if exposed to north or west blasts of winds, and has many windows, it is safe to count only 400 cubic feet of air for every square foot of heating surface of the boiler; or, to take recourse to the other alternative, run the boiler at higher pressure, which of course means at a higher temperature. This, however, is according to the statement of experts, not so advisable for the heating of ordinary single buildings; however, when a large building, or a whole section of a city has to be heated, the case may be different, as it will require more pressure to conduct the steam to greater distances.

The next estimate has relation to the steam coils or radiators placed in the rooms to be heated, by the condensation of the steam in them, which, by the very act of that condensation, will give up its latent heat—that is, 962 units for every pound of water condensed. It is evident that this radiating surface must far surpass that of the heating surface of the boiler. The latter is exposed directly to the fire—that is, to a heat of about 2,200°, while the steam sent out at 5 pounds pressure can only heat the coils to say 220°, and it may be made to diffuse itself over a surface equal to the quotient of these two numbers, that is, $2,200 : 220 = 10$; so that we may estimate that for every square foot of boiler surface, and for every 500 cubic feet of air to be heated, we ought to have 10 square feet of radiating surface of coils, plates, or whatever the form of the radiator may offer. (This is equivalent to 1 square foot of radiating surface for every 50 cubic feet of air to be heated).

As a stationary boiler, when used at such low pressure, requires about 50 square feet of heating surface for every horse-power, (Cornish boilers are estimated at 60 square feet per horse-power), then 50 square feet will be capable of heating 50×500, or 25,000 cubic feet of space; and being very economical, will consume no more than from $2\frac{1}{2}$ to 3 pounds of coal per hour per horse-power—that is, for every 25,000 cubic feet of space to be heated, which is $2\frac{1}{2} \times 24 = 60$ pounds of coal every 24 hours. Let the total space in an ordinary dwelling-house to be heated be 42 feet long, 20 feet wide and 30 feet high, that is 25,200 cubic feet, which nearly corresponds to the volume we found that can be heated by means of a horse-power boiler consuming 60 pounds of coal in 24 hours.

If we suppose a large house covering a full city lot, of which the dimensions are 25 feet wide, 60 feet long and 35 feet high, we find the number of cubic feet to be 52,500, and this would require double the former boiler, and fuel consumption — some 120 pounds of coal in 24 hours, which agrees perfectly with what was estimated by the engineer who wrote the article upon which we made comments on page 243. He supposed a house of large dimensions, or supposed a less economical steam boiler; at any rate, we must conclude that his estimate, while not far out of the way, is only susceptible of reduction by the practice of proper economy.

Humbug No. 4.—Prescott's New Use of the Divining Rod.

Our attention has been called to a letter from the Prescott brothers in Merrimac, published in the *Exeter* (N. H.) *News-Letter*, from which we copy the principal passage, and give our answer. Speaking of our criticism, they say:

"The writer refers to us as imposters, and to persons who have embraced our method as superstitious fools. So strong are the symptoms of his dissatisfaction, that we are inclined to believe him to be one of the lightning rod men. If the writer had made a careful investigation of the matter before penning the article of ridicule mentioned, he would undoubtedly have saved much trouble and ink, or his reflections would have been of a different type. We feel sorry to think we are driving his business away from him, and hope he will forgive us, but the public are insisting on and adopting our sure and simple method of protection from lightning."

We assure the Prescott brothers that we are by no means one of the lightning rod men, and wish them all possible success in their business. The cause of our dissatisfaction does not arise from the fact that they have put up efficient lightning rods; on the contrary, we congratulate them, and if their rods are effective, they will speak for themselves and be the best recommendation, to which they should appeal instead of to the method they have adopted of throwing dust in the eyes of bank presidents, treasurers, clergymen, and even teachers, who may never have had occasion to learn anything about electricity, and in their ignorance regarding the matter are fit subjects to be deceived by the false and ridiculous pretences that a divining rod in the hands of the Prescott brothers will, by their most wonderfully sensitive organizations, detect currents which no other man can; that they almost "smell and taste the electricity beneath their feet." That is what the papers state to be their claims, and if they do not renounce such claims, we denounce them as the most unmitigated humbugs, who only resort to such deception in order to attract business from the ignorant.

If they have put up effective lightning rods, as they claim, and which we have no reason to deny, it is no proof that the humbug by which they appear to have secured their business is not a humbug after all. Any one who knows that a good ground connection is the essential thing in lightning rods, can erect a good and efficient one. That the Starr lightning rod, according to their statement, did not protect Hallet & Davis' piano manufactory, while their readjustment did, was simply a proof that it was not properly connected with conducting layers. If the readjustment made by the Prescott brothers improved this defective connection, they did a good thing; but it had nothing whatever to do with their humbug divining rod, which can do no possible good, except, as we have already stated, attract business from the ignorant. They should leave such nonsense to fortune-tellers and astrologers, especially as the lightning rods they erect are not humbugs, like those of the Chambers National Lightning Protection Company, and which we found it our duty to expose in the November number of this journal.

In regard to the suggestion of the Prescott brothers, that if we "had made a successful investigation of the matter, . . . our reflections would have been of a different type," we answer that we have made electricity a study of our life—that more than fifty years ago we were much interested in tracing out the apparently capricious course of lightning when striking buildings with and without lightning rods, and did this for years every time that a place where lightning had struck was within our reach. The true principles on which the proper construction of lightning rods is based, we condensed in an article on this subject on page 75 of our March number for 1879, the perusal of which we recommend to all "lightning rod men," most of whom sadly need the information therein contained.

This is also proved by the assertion made by the Prescott brothers toward the end of their letter, that "water, finding its own level through the different strata of the earth, produces what we call electric currents."

No such thing. Water, or moist earth, is simply a conductor of electricity, which is generated by evaporation, making the clouds positive and the earth negative—that is all.

The letter closes thus: "We should enjoy a social chat with the writer in regard to adjusting lightning rods, believing we could arouse him from the old method, and give some points of interest, if not on electrical currents, we are confident we could on farming."

We will be happy at any time to receive information from the gentlemen on—farming.

Light and Heat.

Our attention was attracted by the above title to an article by Henry Raymond Rogers, M.D., of Dunkirk, N. Y., first published in the Buffalo *Sunday Courier*, and reprinted in the *Journal of the Telegraph*. A country paper, not claiming to be scientific, might be pardoned for inserting the article referred to, written by a man who, in almost every sentence, proves that he knows very little of the subject he treats, and who makes several statements contrary to what science has demonstrated; but that a journal published in the metropolis of the American continent, and claiming to be scientific, should have no one on its editorial staff who is enough of a scientist to see the utter worthlessness of the whole article in question, and publishes all its nonsensical utterances without comment, is a disgrace to the scientific reputation of the United States, while at the same time much harm is done by the diffusion of erroneous theories and of statements which are utterly untrue.

We feel ourselves called upon to correct the theories and statements referred to. The writer begins by reproaching scientists for having thus far ignored the two forms of light and heat, which he holds to be combustion and magnetism. By the latter he means the light and heat produced by electric currents, which do not appear at the seat where they are generated, like the light and heat of combustion, but, as the writer expresses himself, "this magnetic force, while permitted to flow freely through a perfect conductor, is never developed into light and heat, but is only concerted into these forces as the current encounters and overcomes resistances." He further says: "They are transmissible in any direction, and by any pathway, and have scarcely any terrestrial limits. They are transported by wires over continents and beneath oceans, and many miles of space have been transversed by them without any visible means of conduction; but, unlike the former, they do not pass as sensible light and heat. Their functions differ; the light of combustion is feeble in power, while the magnetic form of light may be employed in photography, and by it the various shades of color may be discerned in the night season. In strength and brilliancy the magnetic light resembles the sunlight."

The writer, when he states that the light and heat of combustion do not appear at the seat where they are generated, forgets the works in which gas is generated, while the light and heat which it contains in a latent condition are often evolved miles away from the place of generation. In fact, we now know that there is far less loss in transmitting light and heat in the form of gas than there is in transmitting them in the form of electricity, which do not at all "flow so freely," and have decidedly a very contracted "terrestrial limit," as those who professionally exhibit electric lights have learned to their great annoyance. To say that electricity can traverse space "without any visible means of conduction," is downright nonsense.

It also appears that the writer desperately confounds electric currents and magnetic force, which are by no means the same thing, however closely they may be related. He persists in calling the electric light "magnetic light," while it is well known that it can be, and was at first, exclusively produced by simple galvanic batteries, without the aid of any magnetism, and that only at a later date, after it was found that magnetism could produce electric currents, were magneto-electric machines used to develop electric currents. To say that it is magnetic force that flows through conductors displays as much ignorance as when he says that the light of combustion is feeble in power, while the "magnetic form of light may be employed in photography." The fact is that the light of combustion may be made as strong and as well suited to photography as the electric light, the combustion of magnesium metal, of bisulphid of carbon with nitrogen, of phosphorus in oxygen, or of oxygen gas blown upon burning sulphur, which are all adapted for photography, while only a strong electric light will answer the purpose. It is not a question of the origin of the light, but of its temperature.

The writer wants to deduce the conclusion that the sun shines by "magnetic light," and tries to obtain another argument from the fact that by the "magnetic light colors can be distinguished." Unfortunately for his theory, the light of burning magnesium shows colors just as well as the electric light; so does the light produced by the ignition of many other substances, if it is only pure white light, and not yellow, like that given by our ordinary gas, lamp and candle lights. He thinks it "a great relief" to suppose that the solar light is magnetic, as then he says "we are eased of the great burden of finding adequate supplies of material to keep up the vast conflagration supposed to rage at the sun;" and then expounds in regard to the tax of the old theory upon the ingenuity which "neither we nor our scientific fathers have been able to bear." He says that if we only adopt his magnetic theory, the trouble about the "waste involved in the theory of combustion process, enormous beyond computation," will all be relieved, and the great law of the conservation of force, which was jeopardized, be maintained.

Does Dr. Rogers then think that he gets his magnetic (electric) light for nothing? Does he forget that for its production he needs a colossal galvanic battery consuming zinc and acids by the pound? or that he wants a steam engine to drive the dynamo-electric machine producing the light? so that in the end he needs a combustible material as much as if he made a fire and used its more diluted heat and light directly, without the intervention of electric currents; and we ask him: Where is the galvanic battery or the dynamo-electric machine, with the power driving it, which supplies the solar magnetic (electric) light? It is easy enough to pretend that the source of solar light and heat is electric or magnetic if you choose, but this explains nothing if no further explanation is added in regard to how the electricity is generated.

We pass by some other confused notions expressed by Dr. Rogers, and will only mention the analogy he finds between the attraction of our little magnetic batteries and the attraction or gravity of the great sun battery, as he calls it, and which attraction, he says, "is likewise an integral constituent with sunlight and sun heat." Unfortunately for such speculation is the well proved fact that gravitation is entirely independent of heat and light.

But the worst is yet to come. In his eagerness to

defend his magnetic theory of solar heat, he says: "The simple fact that the earth receives its heat and light through the agency of the sun, is not conclusive evidence that the sun itself is hot. On the contrary, *it is well known that the heat rapidly diminishes in the direction of the sun. . . . The sun is not inherently brilliant. Beyond the lower portion of our atmospheric mass there is no dazzle. Only a short distance upward from the earth, at a point where respiration, by means of the rarity of the atmosphere, becomes impeded, the human eye may behold the great orb undazed.*" The italics are ours, and we italicise the passage because the statement is utterly false. At a hight of say two miles above the snow line, the light becomes so dazzling that travellers have to protect their eyes against the glare of sun and snow; while in regard to heat, Pouillet, with his pyrheliometer, proved, fifty years ago, that the heat radiating power of the sun is found greater and greater the higher we ascend; and he has even established formulæ determining how much heat is lost in the lower strata by the absorbing power of the atmosphere. We may add that Tyndall has proved the same facts by other observations.

The false theory propounded by Dr. Rogers was only invented to explain why it is so cold on the tops of mountains by those who have not perspicuity enough to understand the true cause. What this true cause is of the greater cold on mountain tops, we have explained on more than one occasion in former numbers.

Steam Pipe and Boiler Coverings.

Within the past few years particular attention has been given by practical, scientific men to the economical production and utilization of the forces generated by steam, and valuable appliances, such as heaters, condensers, traps, etc., have been perfected, which have, to some extent, effected a saving of fuel; but in the direction which has always been deemed of greatest importance—that is, the prevention of radiation from heated surfaces, but little improvement had been made over the hair felt jackets in common use, until the discovery and demonstration of the value of asbestos coverings, in the use of which, by improved methods, results have been produced which were never before attained in preventing the radiation of heat and consequent saving of fuel, and steam can be carried greater distances than has ever before been found practcal, and delivered "dry"—that is, hot, dry and elastic.

Hair felt has been long and largely used, and when covered with a painted canvas has proven the most effective appliance for these purposes, previous to the introduction of asbestos coverings, and so long as it remains uninjured, forms a desirable protection; but, as is well known, hair, in contact with heated surfaces, soon loses its vitality and becomes a dry, crisped mass, possessing no non-conducting power, and often becomes ignited, and destructive to life and property. This charring and burning is effectually prevented by the use of the asbestos lining.

Many cements and so-called "feltings" have been sold and applied for these purposes, none of which have proven durable or satisfactory as *real* "non-conductors." Most of these mixtures, sold under various names, have few advantages over mud or common mortar, but when applied as thick masses are deceptive, as they furnish a larger radiating surface, and apparently effect a saving which is not real. For instance, an uncovered *inch* pipe filled with steam, will show a certain quantity of radiated heat—the radiating surface of this pipe is about 38 square inches to the running foot—cover this with any of the mixtures referred to, say 1½ inches thick, as ordinarily applied, and the radiating surface is increased to 150 square inches, or about *four times the original surface to radiate the same quantity of heat.* Such a covering will be comparatively cool to the touch, but a proper thermometric test will show that nearly the same quantity of heat is lost, owing to the fact that the covering is in no sense a "non-conductor." Other forms of covering, with unbroken space between the heated surface and the covering, which serves as a ventilator or draught to carry off the heat, rendering the surrounding air cool, and with other palpable deceptions and faults which can be named, are equally valueless, and the loss of fuel goes on, and in consequence it has become a settled conviction in the minds of many, that the usual quantity of coal must be burned to produce the required steam power.

Many of the most extensive manufacturing establishments in this country are to-day wasting from 20 to 30 per cent of their coal, after having expended thousands of dollars for these deceptive coverings.

In view of these facts, we cannot too strongly urge upon users of steam the importance of securing safe, reliable, permanent and effective non-conducting coverings, and we believe there is no other form of steam pipe or boiler covering which in these respects equals the genuine Asbestos Coverings patented and manufactured only by the H. W. Johns Manufacturing Co., of this city, which comprise Asbestos Cement Felting, Asbestos Lined Hair Felt, and Air Chamber Coverings.

The Empire State Brick Company.

One of the most promising, and at the same time useful enterprises, that has been started recently, is the the organization of the Empire State Brick Company, whose offices are in the Boreel Building, Nos. 115 and 117 Broadway, this city, while their extensive works are at Huntington, Long Island.

We say *promising*, because this company have secured more than 30 acres of clay beds of a very superior quality, inexhaustible for many generations to come. They also have water communication, open during winter with New York and the New England States. They have in perfect working order, machinery, kilns, dryers, and all the appliances with which they manufacture 50,000 bricks a day. The bricks produced are of perfect shape, have beautiful, sharp and well defined edges, and cost less for labor and outlay in machinery than bricks made by any other method.

The machines used by this company are known as the Gregg brick machines, and obtained the highest premiums at the Paris, Vienna, and Centennial exhibitions, and are adapted to make brick and re-press them also, or to re-press hand-made brick, or bricks made by any other machine.

We said also that the enterprise is *useful*, and this for the simple reason of the new feature of ornamental bricks made, while the ordinary bricks introduced in the trade by this company are superior, and will tend to the construction of more reliable masonry. It is well known that a good brick wall is the most reliable of all. Who has not noticed that after a destructive fire the brick walls always stand the longest, because bricks have been in fire before and can stand it, while sandstone cracks, marble burns into quicklime, and even granite suffers and splits up. Any enterprise, therefore, which promises to promote the construction of the most reliable walls—brick walls—by producing better and cheaper bricks, must be considered a useful one.

We may add to this that the success of these brick machines is so great, that in Philadelphia, thus far a great brick-making center, thirty million bricks per year are made there with the Gregg machines alone, not to speak of the millions made at other places. We saw with admiration the operation of the machine at the works, and also a most beautiful model of the same at the late fair of the American Institute.

One of the smaller kinds of these machines is capable of making and re-pressing 10,000 bricks per day, while a special machine is made for re-pressing edgewise the finest grades of front brick, ornamental brick, and fire brick. General Gillmore, in his admirable report upon the Centennial Exhibition, says that "this invention marks a decided improvement in the manufacture of the choicest quality of front bricks." In regard to strength, the test made by the United States government proved that the crushing strength of these bricks averaged from 7,500 to 10,000 pounds for every square inch, which was far greater than any other brick ever tested by the experts employed.

It is the design of this company to supply to the market all grades, qualities, and colors of bricks, such as front or face, shape, cornice, ornamental, enamelled, mottled and variegated, for outside work and inside ornamentation. Hollow bricks for strong, light construction, partition, vault and paving bricks. Special attention will be given to hard, square, well-burned brick, for columns, piers, sewers, tunnels, and all engineering purposes where the crushing weight is great. Brick will be made of all sizes, shapes, weight and strength, as ordered, and special designs of any shape, size or color, for architects and others, from plans submitted by them. Bricks of proper dimensions to suit the Cuban, Mexican and South American trade will be made for export and shipped at nominal freight as ballast. Drain pipe, sewer pipe, and tiling for roofing and paving, of all grades, will be made, the Long Island clay being especially adapted to these products, and large quantities being sold each year to potteries in New York.

One of the most prominent objects at the works is the fancy shaped bricks which are turned out by the machine, of almost every conceivable shape and pattern, some of the patterns being very artistic and beautiful. These are used for house fronts, etc., and will give the architect a larger range of variety. If made by hand, the expense would simply put them out of the question. The quality and color of the brick could be well seen from one of the chimneys, which looked as handsome as the best Philadelphia brick, and seemed almost out of place among the sheds and commonplace surroundings.

The wonderful Gregg machine makes 48 bricks a minute. In inspecting the clay pit one is struck with the admirable character of the deposits and their unlimited extent. The ease with which the clay is railroaded from the bank into the machine shows how cheaply the manufacture can be carried on. In fact, it would seem difficult to improve in the economy and apparent good management at the works. The labor can be carried on during most of the winter.

The clay is so homogeneous, and the shape of the brick so accurate, that builders much prefer a material upon which they can depend with so much accuracy. The bricks break in a very shapely way to the trowel on account of their solidity. If ordinary bricks tumble down many of them break, while among these a broken brick can rarely be seen.

As a proof of the enormous demand which must continually exist for bricks in a country so largely increasing in population as ours, it may be stated that in New York city alone not less than 500,000,000 bricks are wanted per year, which would require the making of 1,700,000 brick each working day—more than thirty times the capacity of the present works at Huntington, so that there is demand enough to justify a large extension of the company's business.

Stamping Thermometer Plates.

Messrs. Robinson & Burr, machinists and founders, of Champaign, Ill., have recently completed a very intricate machine for graduating and stamping thermometer plates. The machine stamps the figures from 40° below zero to 280° above, and makes the long and short marks; but what is the principal and indispensable feature, the length of the degrees can be varied according to the proportion of the thermometer tubes to which the scale is to be attached. It is evident that the narrower the tube in proportion to the contents of the bulb the longer must be the degrees, and *vice versa.* This machine does away with the most tedious and slowest part of thermometer making, and is a perfect success, as it will stamp four gross of plates per day.

The largest steel cannon ever cast in Russia is now the subject of experiments in St. Petersburg. It was made in the government foundry at Obukhoff, is 16 inches in diameter, 120,000 pounds in weight, 35 feet long, and throws a ball nearly five miles.

The only Sensible Lightning Rod Man.

It may appear incredible, but it is a fact, that during our whole life we have met only one sensible lightning rod man; by this we mean to say that only once did we meet a man who made the erection of lightning rods a business, and had at the same time sound ideas of electricity and its laws, or lightning and its laws — exactly the same thing, with the difference only of quantity, which is in about the ratio as the size of our electric machines to the size of thunder clouds.

This man is Mr. Henry W. Spang, of Reading, Pa.

We became aware of this fact on receiving a book entitled, "A Practical Treatise on Lightning Rods," written by the party named. We reviewed it on page 214 of our September number for this year, and gave the favorable opinion which it so fully deserves.

Three reasons induce us to take up the subject again. They are: 1st. The extensive advertising of two humbug lightning rods by the Chambers National Lightning Protection Co., of Cincinnati, and the divining rod of the Prescott brothers, of Merrimac, Mass. 2d. The accusasion, or at least suspicion, of the Prescott brothers, that we are in the lightning rod business ourselves, and damaged by their great success. 3d, and principally, a feeling of justice due to the only sensible lightning rod man, whom however we have never seen, and therefore testify impartially.

We do not mean to say that there are no other good lightning rods, but we say that the men who put them up, do so either by rote or by good luck, and have not a clear conception of the theory of their own business. The Prescott brothers named are a case in point. We urge the consideration, however, that in order to be safe it is best to go to a man who understands his business thoroughly, and this is the one we recommend.

We are pleased to have the opportunity of placing before our readers an illustrated description of the principles on which Mr. Spang bases his practice and the devices he applies; they consist of the employment of broad metallic conductors, water, and well moist earth; a round iron rod G, Fig. 1, extends along and above each chimney, or a metallic chimney cap or ventilator as an air terminal conductor, connected with the metal roof B, and each rain pipe A about the building connected by a suitable flat or round iron conductor D with the iron pipe C, having perforations or openings P. The perforated pipe C is placed

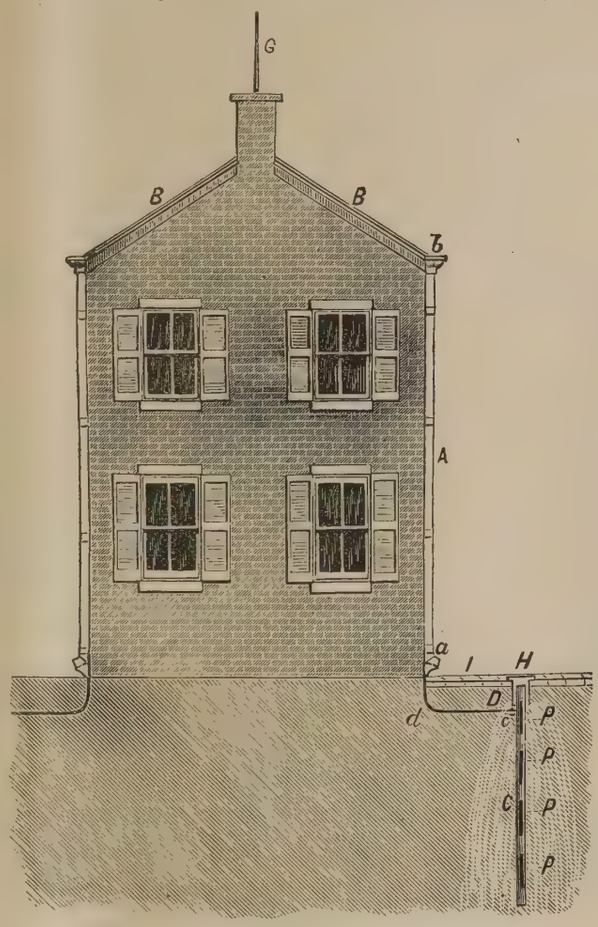


Fig. 1.

vertically in the earth at a gutter or drain I, and its top is surrounded with a perforated cap H, through which only the waste and rain water can enter and moisten the earth around and beneath it.

During the beginning of a thunder-storm, the water from the rain pipe A, flowing along the gutter I, will soon fill the pipe C and flow in a body over the cap H, and establish an electrical connection between the top of pipe C and the moist surface earth. The moist earth around and beneath the pipe C, together with the water flowing along gutter I, and the moist surface earth will greatly diffuse and weaken the electricity in a lightning discharge, and thereby properly protect the building. This perforated iron pipe is a reliable method by which the waste and rain water can be made use of for maintaining a suitable area of moist earth and effecting the proper diffusion of the lightning in the earth.

Should the building have a shingle, slate, gravel or tile roof, it is necessary to employ sheet-metal bands or conductors D and G, Fig. 2, in short and direct lines beneath, wooden sheathing or slate covering between the conductors A, C, E and F, and the metallic trough or gutter J at both eaves of the roof. In the case of a mansard roof, the rain pipes or sheet-metal conductors employed along the roof can be used as the connecting bands or conductors between the metal covering upon the deck roof and the metal gutters leading to the earth. Where they are not in direct lines with the rain pipes, it will be necessary to employ suitable sheet-metal bands beneath the slate covering or wooden sheathing.

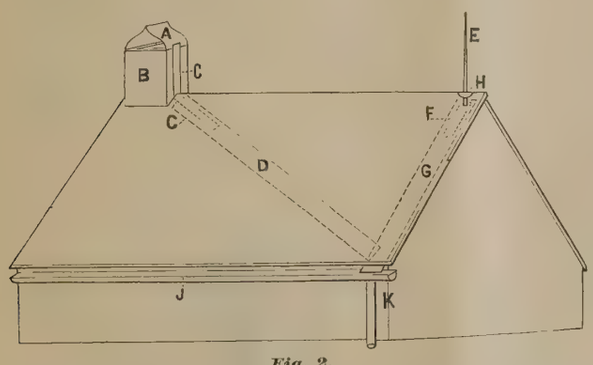


Fig. 2.

In a zigzag, or rather spiral lightning discharge between a cloud and the earth, an immense quantity of electricity is concentrated, giving rise to a great expansive action for any objects over which it can readily spread out, and it will invariably alight upon a large metal mass like a metal roof, a gas-holder, or an oil tank when beneath a thunder cloud, for the reason that they offer a wide scope for its expansive action. In order to properly protect a large building, it is necessary to provide it with broad metallic conductors, arranged so that they will offer a better scope for the expansive action of the electricity, and an easier path to the earth than the path offered by the building. A metal roof, with conductors attached thereto, and connected by means of four substantial rain pipes, with four perforated iron pipes, placed in the earth (a pipe at or near each corner of the building) will effectually protect a large building. A high steeple must have the metallic ornament or rod at its top connected with the metal roof of the building by means of sheet-metal bands; and in case of a wooden or slate roof, the bands must be extended beneath the roof in direct lines with the nearest rain pipes on each side of the building, and be soldered to the metallic troughs or gutters.

In Fig. 3 is shown the best arrangement of metallic conductors for protecting a barn, schoolhouse, etc., having a shingle or slate roof. The air-terminal rods C, C′, which pass through the ventilators A A′, are connected with the metallic gutter or trough E on each side of the roof, by means of flat bars D D^1 D^2 D^3, and the sheet-metal bands or conductors H J K L, which are placed beneath the rafters or wooden sheathing or slate covering. The rain pipes F and G on each side of the building, being each connected with a perforated iron pipe, so that a lightning discharge taking place in line with the air-terminal rod C or C′, will spread out over four metallic paths, which will offer it an easier passage to the earth than the material of which the building is constructed.

If the air-terminal conductors, metal roof, or sheet-metal bands beneath a shingle, slate or gravel roof, metal gutters, rain pipes, and perforated iron pipes are well connected together, and a line of moist earth exists between each perforated pipe and the subterranean water-bed, there is no danger whatever of the wood-work or other material about a roof, steeple, or building being set on fire or damaged, or any person beneath the roof or inside the steeple or building, being injured by the electricity during a thunder-storm.

We will add to this that Prof. Anderson, in a speech before the British Association of Science, said that so slow had been the march of progress since the days of Franklin, that lightning conductors are still wanting on most public buildings, and on nearly all the private houses in Great Britain. The terrible losses occasioned by lightning are due, he asserts, to three sources of neglect, namely, not providing any lightning rods at all, not placing them in the proper and effective position, and, finally, not having them regularly tested. Lightning rods, he declares, ought in all cases to be tested once a year; it should be done, of course, by a competent person.

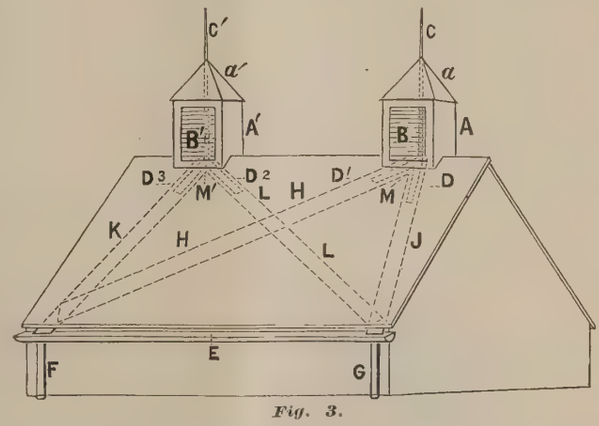


Fig. 3.

These lightning conductors are now being put upon buildings in many large Western cities and towns, where they give the best satisfaction. In order to introduce this system of lightning conductors throughout the United States, the inventor will sell at a reasonable price the New England and New York States, many Southern States and Canada.

For further information, copy of claims of patents, terms, etc., apply to W. Taft., Tolland, Conn., sole agent for inventor.

Riveting.

BY ROBERT GRIMSHAW.

The rivet is a device employed, in general, to unite two plates of metal quite firmly together. Occasionally, as in a pair of scissors, the rivet acts also as a

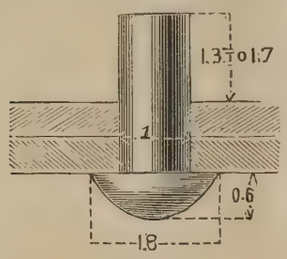


Fig. 1.

pivot; but ordinarily it is not a center of turning. In most cases the strain upon it is a lengthwise pulling or tension, as in boilers, although in some instances, as in lattice bridge work on the English system, there is, instead of a pulling strain, a *shearing* action crosswise of the length of the rivet.

The ordinary rivet is of wrought iron, and has, when made, a first head, which may really be called the *tail;* and a cylindrical shank, body, or stem; and after being placed has a second head given to it, by upsetting the cylindrical stem. In Fig. 1 is shown a rivet uniting two plates, and it has marked on it the proportions which the various parts should have, as compared with the diameter of the stem. It will be seen that an "inch rivet," that is, one having a stem 1 inch in diameter, should have a head 1.8 inch diameter and 0.6 inch high, and that the shank should be long enough

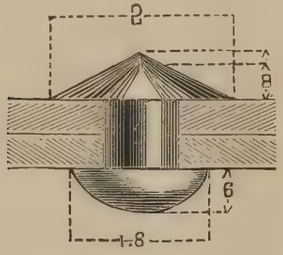


Fig. 2.

to project from 1.3 to 1.7 inch through the two or more plates which are to be united. Fig. 2 shows this rivet headed up by hammer blows delivered obliquely, and thus forming a conical head 2 inches in diameter and 0.8 inch high. These dimensions are larger than those of the first head, as the metal is less perfectly compressed and the shape not so advantageous. If a cup or former, sometimes called a "snap," be used, so as to finish the conical head, the conoid form is given, as in Fig. 3, and which has the advantages of sightliness, regularity, and slightly increased strength. In Fig. 3 the first head is not spherical in shape, but more flattened. Figs. 1 and 2 show plates which have had the holes drilled in them; rather expensive in any case, and unnecessary with iron plates.

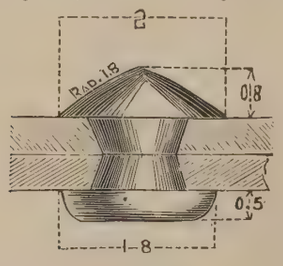


Fig. 3.

In Fig. 3 the holes have been punched, and as the die is always larger than the punch, to give "clearance," the holes are tapering. This form is better in those cases where the strain on the rivet is one tending to pull the heads off, as the metal of the shank is forced out (or ought to be) into an hour-glass form. Of course the plates are so put together as to bring the small ends of the holes together. Where a hole is necessarily drilled, as in a steel boiler plate, reaming or countersinking, as shown in Fig. 4, gives the same result as is afforded by the taper holes of the punching machine. The second head in Fig. 4 is flatter than in the others, as is sometimes demanded. In fact, there are cases where the head must not project at all, as in iron shipbuilding; and in this case the sheet is counter-sunk quite deeply, as shown in Fig. 5, and there is very little head left projecting after finishing. It is difficult to assign a length for a shank for this case, as in those shown in the first four cuts.

Good Norway iron will rivet quite well cold, but where it is required that the joint be very staunch, it is best to have the rivet fully red hot, so that one may be more certain that the hole is fully filled by the shank, and that the contraction of the shank in cooling may draw the plates still tighter together and keep the

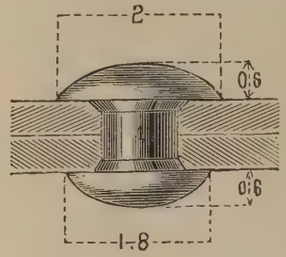


Fig. 4.

plane faces of the heads in absolute contact with the plates.

For bridge-work it is essential that the proportions of the rivets be very carefully determined and adhered to. Figs. 6, 7 and 8 show round, elliptical, and sunken heads. Hammering the head of the rivet, and the plate in its vicinity, is not calculated to better the resistance of the plates, as these last are really stretched as by *pening*. Steam riveting is largely employed, but hydraulic pressure is much better, and causes the shank to fill the hole absolutely and tightly; besides, the hydraulic machine is more readily controlled.

Where a rivet acts as a *pin*—that is, where it resists shearing strain, its strength may be calculated by mathematical formulæ. Figs. 9 and 10 show two modes of connecting links by rivets; Fig. 10 is chain riveting, and is mostly seen in bridge-work. The proportion between the thickness and strength of the

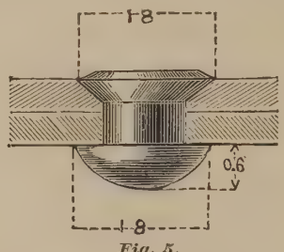


Fig. 5.

plates and of the rivets should always be closely studied. We may say in general that for bridge-work rivets of great diameter at comparatively great distances apart are better than small ones close together.

For boiler-work the necessity of avoiding leakage makes it imperative that the rivets be close together; for thin sheets the diameter and the distance apart of the rivets should be proportionately greater than for thick sheets. Fig. 11 shows a single row of rivets in section and on top view; Fig. 12, double riveting, the rivets being placed "staggering," as they should invariably be. The edges of the sheets should, if possible, be cut with a slight bevel, to facilitate calking; and this calking should invariably be done with a round-nosed tool, so as to insure perfect contact and to prevent *scoring* of the under plate. The joints of cylindrical boiler shells ought to run spirally around the shell, to give the greatest strength.

In using rivets of *very* long shanks, that is, with stems disproportionately long for the diameter, care should be taken not to heat the stem too hot, or else not to heat it throughout its whole length, as otherwise the contraction in cooling tends to pull the heads off.

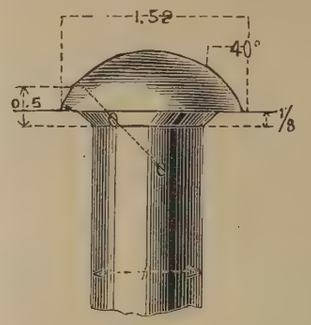


Fig. 6.

While it is best to drill all rivet holes in steel plates, on account of punching altering the temper and causing liability to crack, the holes may be punched somewhat smaller than needed, and then reamed out; or the sheet may be annealed after punching.

Recent experiments in punching iron sheets show that a punched hole is stronger than a drilled one—that is, leaves the plate stronger; for in punching there is a good deal of metal that is crowded into the sides of the hole instead of being punched out, and the deeper the hole in proportion to its diameter the more of this flow of metal and condensing it in the walls of the hole do we find.

Manufacture of Paper.—Of the 1,300,000,000 human beings inhabiting the globe, 360,000,000 have no

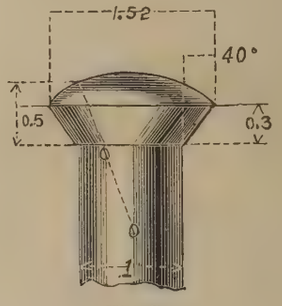


Fig. 7.

paper nor writing material of any kind; 500,000,000 of the Mongolian race use a paper made from the stalks and leaves of plants; 10,000,000 use for graphic purposes tablets of wood; 130,000,000 (the Persians, Hindoos, Armenians, and Syrians) have paper made from cotton; while the remaining 300,000,000 use the ordinary staple. The annual consumption by this latter number is estimated at 1,800,000,000 pounds, or an average of 6 pounds per person, which has increased from 2½ pounds during the last fifty years. To produce this amount of paper 300,000,000 pounds of woollen rags, 800,000,000 pounds of cotton rags, besides

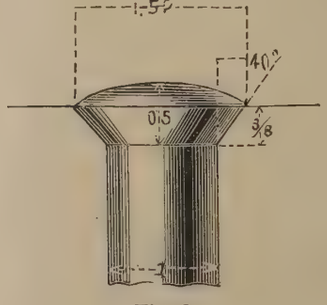


Fig. 8.

great quantities of linen rags, straw, wood, and other materials are yearly consumed. The paper is manufactured in 3,960 mills, employing 90,000 male and 180,000 female laborers. The proportionate amounts of the different kinds of paper are stated to be: Of

writing paper, 300,000,000 pounds; of printing paper, 900,000,000 pounds; of wall paper, 400,000,000 pounds; and 200,000,000 pounds of cartoons, blotting paper, etc.

Toughened Glass Sleepers.

At a late meeting of the British Iron and Steel Institute, in Liverpool, Mr. C. Wood read a paper on the subject of toughened glass sleepers for railroads, from which we make the following extracts:

"The glass is molded into various forms to suit the different requirements, the cooling of the glass being so regulated that the radiation from each point of the surface corresponds to the thickness of the glass, thus enabling the casting to be equally affected throughout

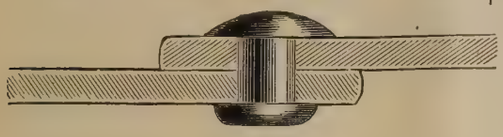


Fig. 9.

when undergoing the tempering or hardening process. The regulation of the radiation or absorption of the heat in the thicker parts of the castings is done by having iron molds hollow, and by circulating cold water or cool air at those points where the glass is thickest, so that the glass cools equally all over.

"The mode of toughening the glass is both curious and instructive, affording as it does a complete contrast to that of steel. The glass is heated to a high temperature and then plunged into a bath of cool oil or other liquid, the result being that the glass becomes converted from its own characteristic brittleness to the remarkable tough, fibrous material known as toughened or tempered glass; but to produce the desired

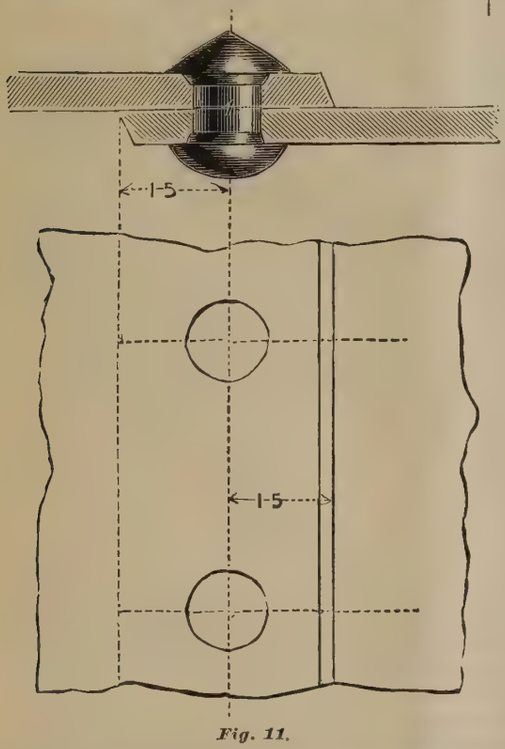


Fig. 11.

effect, and obtain the full advantages of the toughening process upon articles of great strength and thickness, Mr. F. Siemens has found that the hardening or tempering can be effected in the molds themselves: First, by carefully protecting the glass from coming in direct contact with the metal mold, to prevent the chilling of the surface of the glass; and second, by the use of the hollow mold before spoken of, for maintaining a uniform temperature all over the castings during the hardening. The temper is modified in these thick castings by passing them through an annealing oven.

"The molds are chiefly protected by layers of wire gauze, perforated metal, or plaster of Paris, varying in layers or thickness according to the rapidity and energy required in tempering, with the nature and composition of the glass—this energy being increased at the thick parts of the casting before alluded to by the circulation of cool water or air through the cast-iron hollow mold. So far as experience has shown, all kinds of glass are equally affected by the process.

"The toughening process, as well as the hollow molds, are the patent of Mr. Frederick Siemens, of Dresden, and recently brought to great perfection by the simple and inexpensive means above alluded to. The first cost of this specially prepared material will not exceed that of cast-iron, but the specific gravity of glass is only one-third that of iron, and its strength for all practical purposes is as great. A large out-put is anticipated, and in this way it is calculated that the first cost of glass will be considerably less than that of iron; and, by a similar calculation, can be shown to be cheaper than wood. It is asserted that these glass sleepers will, as far as one is able to judge, last a very long time, being neither subject to corrosion nor decay. Under these circumstances, it will be unnecessary here to enter into any calculations to prove the enormous saving that will be effected in the maintenance and renewal of permanent ways. Such a fragile material as glass has hitherto been looked upon as useless for purposes where great strength is required; but impossible as it may sound, the toughened glass is almost as strong as iron, while it possesses greater durabitity. Its qualities certainly deserve a fair trial and investigation, and the time may come when we shall not only see glass sleepers, but glass tools and implements, eaves throughings, or spouting.

"Some of these glass sleepers are laid down upon the North Metropolitan Tramway. They are laid longitudinally in 3-foot lengths, 6 by 4 inches, and are specially formed on the upper surface to allow of the rail exactly fitting. The average transverse resistance of the sleepers, tested at Mr. Kirkaldy's works in Southwark, supported at 30 inches, was found to be about five tons.

"Mr. Bucknall, the inventor of the sleepers, proposes to make them out of blast furnace slag under Mr. Bashley-Brittain's process, combined with the toughening process of Mr. Siemens. After describing to the writer the difficulties he had in getting his experiments carried out in England, the inventor mentioned, among other things, that the glass-makers to whom he applied would not undertake any experiments unless all expenses were paid, and that these manufacturers would not make the molds or presses for the process, but recommended other firms. On application to the press-maker, however, he got a quotation asking between $350 and $400; and it was stated that it would take three months to invent, and that he must be responsible for any extra charges made. 'Under these circumstances,' he said, 'I gave up in despair; but, having casually heard of the Siemens process, I got an introduction, and was put in communication with Dresden, and within a week found myself at the glass-works of Mr. F. Siemens in that city. In another week, a wooden model, which cost 60 cents, was produced, and an iron mold made from it, which cost about $7.50, and, two days afterwards, I held in my arms the first glass baby sleeper; but so heavy was the first-born that it suddenly slipped from my grasp and fell with a heavy thud upon the flags. I feared for the safety of my darling's carcase, but upon careful examination I found it to be unimpaired. There its longitudinal form lay upon the ground, not dead, but a veritable sound sleeper, still living, and probably worth more than a dozen dead ones.'"

REMARKS ON THE ABOVE.

In regard to the above, we feel inclined to express our lack of confidence in the practical application of this material for railroad sleepers. The advantages of wooden sleepers, are that railroad spikes are easily driven into them; but how about making reliable fastenings of the rails to glass? and how about tightening when a rail becomes loose? Then wood possesses an elasticity which is not only very desirable as a seat for the rails, but necessary. On the first experimental elevated railroad in Greenwich street, this city, the rails were fastened directly upon the large **T** pieces which crowned the columns supporting the road; a great improvement was effected by putting wooden sleepers across on top of these rails, and then other rails on top of these sleepers; and this is essentially the principle upon which now all the New York elevated railroads are constructed.

Another example occurs to our mind. Some forty

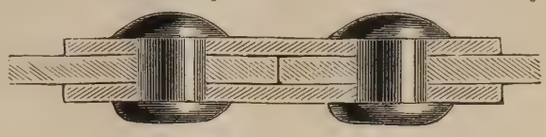


Fig. 10.

years ago the Camden & Amboy Railroad, between New York and Philadelphia, was built on stone sleepers. It was supposed that as stone was so much superior to wood in solidity and durability, that it would be a great advantage, not only in strength, but also in cost of repair. These stone sleepers and piers were all removed thirty years ago and wooden sleepers substituted, and we do not see why glass would have any advantage over stone. The stone referred to was granite, some varieties of which are about as strong as the toughened glass referred to.

USEFUL CAR-WHEEL ATTACHMENT.—A San Francisco inventor has made a model of an improved car wheel,

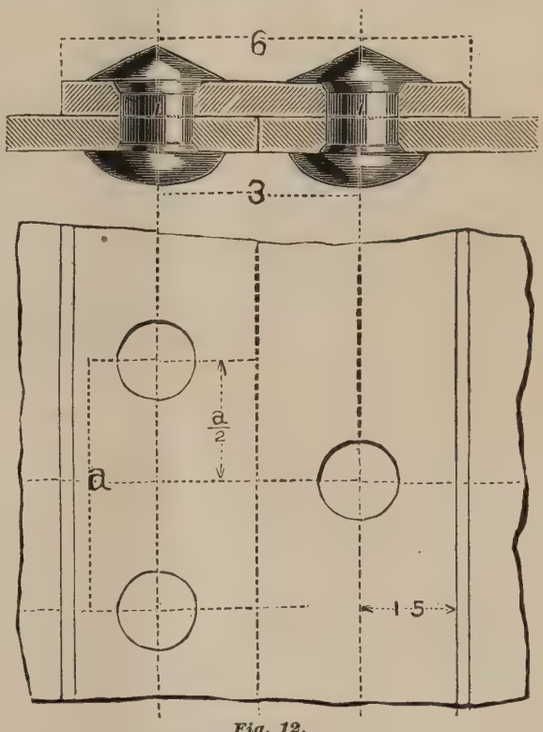


Fig. 12.

the purpose of which is to relieve the propelling power of a good deal of the difficulty now experienced in setting in motion a car that has once stopped. The tire is bevelled on the inside, and fits into corresponding grooves at the ends of the spokes, around which it is free to revolve. There are only two pairs of spokes, the one being fixed permanently to one of the two axles given to each pair, and the other being movable at the will of the person in charge of the car. By a peculiar contrivance these movable spokes are made to throw the weight of the car and its load from the center, so that when the car starts the revolving tire of its own gravity seeks to renew the disturbed center, impelling the car forward. The movable shaft or

spokes and the weight of the car can be thrown off the center at will in whatever direction it is desired to send the car.

A Great Steamship.

The Cunard Steamship Company have just concluded a contract with James and George Thomson, by which that firm is to build on the Clyde a screw ship the size of which will be exceeded only by that of the "Great Eastern," while the speed will be greater than that of any ocean steamer afloat. This new vessel will be of 7,500 tons and 10,000 horse-power, her dimensions being 500 feet in length, 50 feet in breadth, and 41 feet in depth, propelled by inverted direct-acting compound engines, with three cylinders and seven oval tubular boilers, having 38 furnaces and 1,000 feet of effective fire-grate surface. She will have an extra promenade deck, and will practically be a five-decker, being fitted for 450 first-class and 600 steerage passengers, with accommodations for a crew of 200 officers and men. Her cargo capacity will be equal to 6,500 tons, with 1,700 tons of coal and 1,000 tons of water ballast, having a double bottom on what is called the "longitudinal and bracket system."

This vessel has been designed after lengthened consideration, and every detail of the ship and engines embodies the most advanced scientific improvements compatible with the safe working of so great a vessel. Among the important matters has been that of the employment of steel instead of iron, and after a practical and thorough examination into the merits of both materials, steel has been adopted for the hull and boilers, but under a provision so stringent that every plate, before acceptance, will undergo a severe and rigid test by a qualified surveyor appointed and stationed at the steel manufactory for that special purpose, and that the manipulation of the steel by the builders shall be subject to an equally careful supervision by qualified engineers appointed by the company. The steel is to be made by the Siemens-Martin process, and all rivets, as well as plates, throughout the ship are to be of steel. The name of the new vessel is to be "Sahara," and she is to be ready for sea in March, 1882.

Flexible Lining for Kerosene Lamps.

An ingenious invention has recently been introduced in Maryland to insure safety in the use of kerosene lamps. It consists of a lining made of flexible material, which prevents the lamp becoming foul by the expansion of the material of the lamp, permitting oil to exude and soil the hands, or whatever it may touch. A broken lamp becomes harmless, as there is neither gas from the oil nor oil itself to spread destruction to everything it comes in contact with. Careless handling will not bring the oil in contact with a hot lamp. The lining is a natural receptacle for fluids, a non-conductor of heat, and is improved in several essential by being filled with oil. It is strong enough to resist rupture from much rougher handling than can be expected from an article designed for this purpose. No change is necessary in lamps now in use. The attachment is made to fit any kerosene lamp. An accommodation coupling, or joint, enables any one to change their lamp from a foul and dangerous light to one perfectly safe, clean and harmless.

We have not seen this lining, but are confident that it is made of glue and glycerin, a mixture that always remains flexible, and is perfectly oil-proof.

An English Commissioner to the United States.

Our highly esteemed London contemporary, the *Textile Manufacturer*, in view of the feeling of apprehension existing in England, especially in the cotton trades, in regard to American competition, has concluded to send a special commissioner to the United States, in order to investigate personally whether the practical workings of the American industries justifies such apprehensions. As this is the first time that an English class paper has had the enterprise to send to a foreign country a special commissioner to report upon trade, we call attention to the fact, important to all interested.

Building Intelligence.

NEW YORK CITY BUILDING ITEMS.

P. H. Lalor has just completed, on 116th street, west of Lexington avenue, seven houses, having a frontage of 18 feet each. They are all finished in cabinet style, the parlors and various chambers being gotten up in a manner that would do credit to houses of greater pretensions.

An apartment house to be called the Windsor is in course of erection on the corner of Broadway and Fifty-fourth street, fronting one hundred and one feet on the former street, and seventy-three feet on the latter, and has six stories and an attic. The front is of colored brick with stone trimmings, but the Broadway elevation shows to far better advantage than the one on the side street. In the center of the Broadway front is the main entrance, constructed of brick and stone, and flanked by two pair of Nova Scotia granite columns, and four or five steps, of Lehigh Valley stone, lead to the grand vestibule. A notable feature of the front is the bay window on the corner, simulating a tower, the first story of which is in triangular form, the second story is round, the third, fourth and fifth stories of this tower are of an octagonal shape, and they each and all form an integral part of the various suites composing the building. These suites are twelve in number, two on each floor. They are composed of a parlor, library, dining-room, kitchen, four chambers, a servant's room and bath-room. The projecting brick corbels, brackets and cornices on the bay windows are relieved by some fine artistic carving. In the middle of the lot there is an open court separating the building in two parts. This court is 23x40 feet, and the southeast corner of the lot is also fixed as a yard so as to provide additional light and ventilation. The stair cases throughout the building are fire-proof, of marble and iron. The janitor's rooms are in the basement of the Broadway side. The attic is to be used as a drying room for the various tenants. The building will be ready about next Spring, considerable progress having already been made with the plastering. Joseph Agate, of Yonkers, is the owner of the Windsor.

There has recently been completed on Hester street, between Mulberry and Center, a tenement which is the most creditable of its kind in the lower section of the city. It is constructed on a simple lot of 25x100; this tenement, with its high stoop and well elaborated brown stone front and ornamental lintels, at once strikes the beholder as an exceptional building, which has been erected with care, and proper regard for the sanitary regulations not only called for by law, but with due circumspection as to the necessities of light and ventilation. The very fact that the adjoining buildings are constructed several feet on either side of the party lines, at once secures light and ventilation to every interior room in the house. The building is six stories high, has a basement and cellar, and a very roomy store has been constructed in the basement part. On the first floor also is a store, which has been finished in hardwood. It should here be mentioned that the front of the basement store has been built of iron, in contradistinction to the upper stories, where the front, as already mentioned, is of brown stone of a heavy quality, with molded courses and ample carvings around the windows. This mixture of material in the construction of the front, iron below and brown stone above, tends to break up the monotony that so often spoils the look of a building the very minute it is observed by a passer-by. There are also ornamental wrought iron balconies and guards surmounted with handsome balusters, all of which add to the cheerful aspect of the exterior. The hallway and main entrance, virtually dividing the building in two parts, are in the center. On each side of this division are five suites of rooms, making ten suites in all, each suite containing four rooms—a sitting-room, two bedrooms, and a kitchen. All of these forty rooms are carefully furnished with a view not of economy to the owner, but for the purpose of affording light and comfort to the tenants. In fact, the latter claim that in no previous flat have they ever enjoyed so much air and ample convenience. But before ascending to the upper part of the building, we find that even in the basement, where, as already stated, there is a store in front, there are also very commodious bedrooms and sitting-rooms in the rear. And here it should be added that the court yard in the rear, a great and valuable boon to the tenant, measures no less than 20x25 feet, showing that in the entire construction of this model tenement the great principle of light and air has ever been kept in the mind of the architect, James E. Ware. The main hall above alluded to has been laid with marble tiles and finished in hardwood. Flanked on both sides by the various suites, it presents as clean and neat an entrance as can be found anywhere in a more pretentious apartment-house. The various families that occupy these suites are kept as distinct from one another as if there were private halls, the main hall forming a division not usually met with in this class of tenement. Each suite, for instance, has its own sink, and, in fact, the plumbing arrangements are such that even if everything else were not looked at, this feature alone would mark it as an extraordinary tenement for this section of the city. So far as sanitary regulations are concerned, we merely need to call attention to the fact that, unlike the numerous tenements of the East side, there are no yard privies, but the entire rear court is excavated below the yard level and arched over with iron and brick. In the vaults are water-closets decently arranged for each floor, and amply lighted and ventilated with the aid of patent lights. This novel method of constructing closets for tenements should be carefully examined by builders generally, and imitated wherever possible. The roof of the building is constructed on the usual plan, with the exception that above the stairway there is left an abundant opening for light to penetrate. Of course, on this roof there is plenty of room for drying clothes. In connection with this it should be said that the fire escapes are on the rear, outside, and of the most approved pattern. The front parlors are all finished with plaster cornices and nicely carved slate mantels of the latest ornamental design, and black walnut shutters. The bedrooms are all directly in communication with the hall or court-yard, and hence amply ventilated.

MISCELLANEOUS.

The Reading Railroad Company propose to build in Philadelphia an immense depot, covering all of Ninth street between Green and Fairmont avenues, together with the ground occupied by the old depot.

The Cutler Manufacturing Company, at Warren, R. I., has decided to build a new mill for the manufacture of cotton yarn. The building will be about 250 feet in length, 80 feet wide, and two stories high, and have a capacity one-third greater than the old mill.

Plans have been prepared for a large new hotel, to be erected at Cape May City, N. J., on the Mount Vernon property, adjoining the Sea Breeze House on the west. The probable cost of the building, without the furniture, will be from $45,000 to $50,000.

Fred. Bell, architect, of Fulton, Mo., has built, for E. M. Kear, of that place, a brick residence with Mansard roof, containing twelve rooms; cost of building, complete, $5,000; also a frame suburban residence with Mansard roof, containing 10 rooms, costing $5,000, for Dr. T. A. Howard; also a frame country residence three stories and Mansard roof, nine rooms, elegant interior finish; cost, $4,800 for Samuel Grant. Mr. Bell is now engaged upon drawings for a four story business block to be erected on the corner of Grand avenue and Fifth street, Kansas City, Mo., the first story to contain seven store rooms, iron fronts, second story a hall, other stories offices; cost, $18,000; also a block of tenement houses, brick, three stories high, in all containing forty-nine rooms of good size, well lighted and ventilated. This building will be erected on Fourth street, Kansas City, Mo.; will cost, complete, about $10,000.

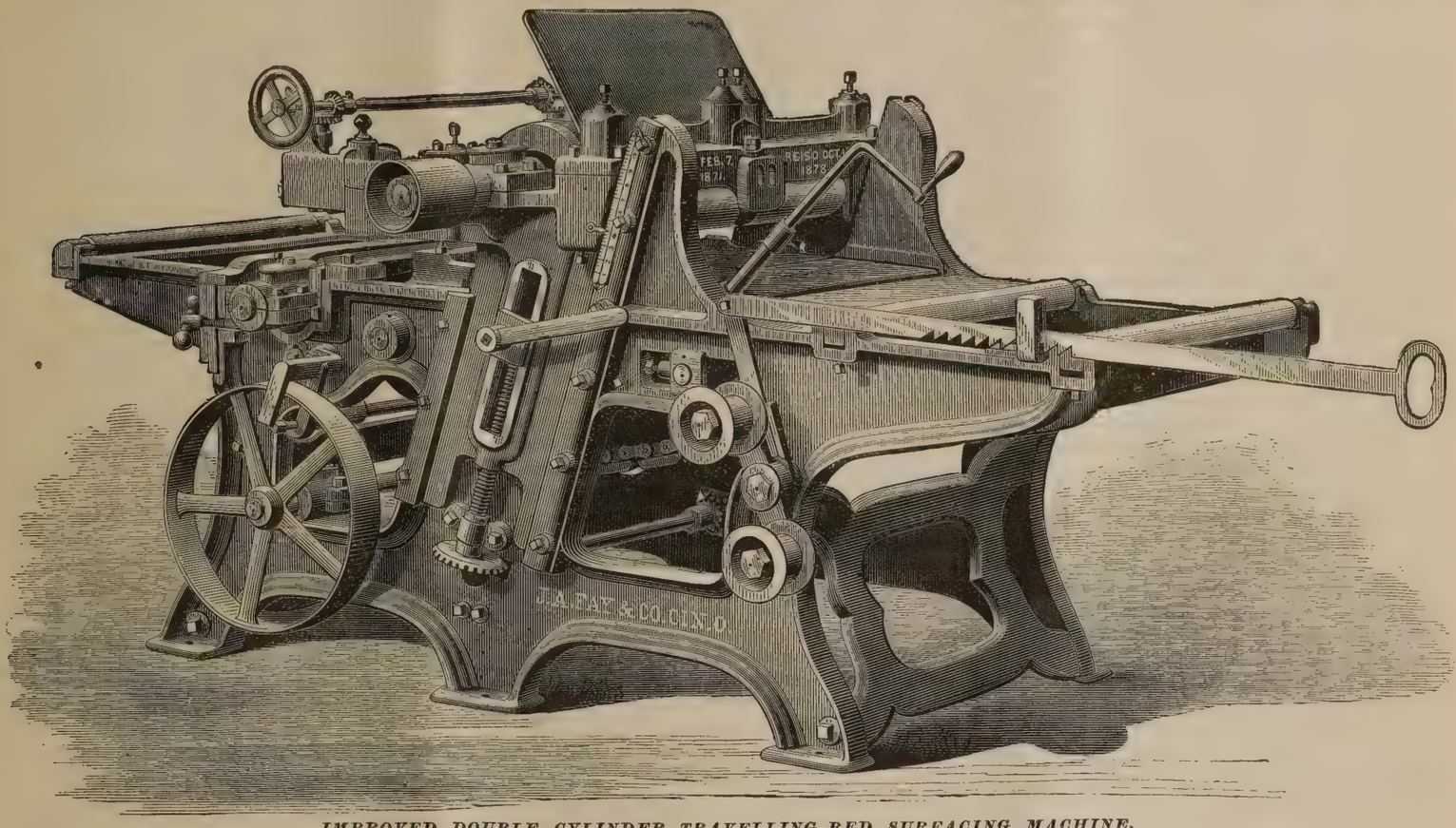
Improved Double Cylinder Travelling-Bed Surfacing Machine.

The surfacing machines with travelling or revolving beds are named after the first maker—"Farrar" planers. They are generally known under that name, and have secured a great popularity, so that even in this age of continual improvements and changes they have not been supplanted by any other method of planing such lumber as they are intended for.

The reason is simply that in surfacing lumber they are said to have no superior for speed or for capacity of production, and where large quantities of lumber are to be dressed, more can be done by the same expenditure of power than by any other machine of different construction. The single cylinder travelling-bed planers are universally known among lumber manufacturers, their merits and capacities having been tested by the most expert and critical operators, and they have always proved their power by the excellence and quantity of their product.

On this page we present to our readers an opportunity for the study of a planing machine which is attracting much attention among lumber men, and which it is claimed will reduce largely the cost of dressing one or both sides of lumber. It has recently been perfected and brought out by the widely-known wood-working machinery builders, Messrs. J. A. Fay & Co., of Cincinnati, Ohio. Its great novelty consists in its capacity to plane one wide or two narrow boards of equal or unequal thickness at the same time. As its title indicates, this machine has two cylinders, one for dressing off the upper surface and the other for dressing the lower surface of the board, while it is passing through the machine. The feeding power is conveyed to the revolving bed, constructed of heavy iron slats or rolls, flexibly connected by links or hinges to the slats, which are carried in the direction desired by a toothed wheel upon a shaft properly geared to produce the correct speed of the lumber. The bed moves over slats placed in a position to produce even wear and as little friction as possible by providing rollers, placed upon either side of the upper cylinder. The rollers receive their pressure from heavy involute springs, regulated by screws. The roller before the cut is divided in its center, forming two rollers, and is termed a "broken roller." They are supplemented by a divided pressure bar, which also forms a most effective chip breaker. This arrangement of the initial roller and the pressure bar is of vital importance, in that it enables the operator to feed in two boards of unequal thickness at the same time, thus equalizing the wear of the machine and doubling its capacity. The upper cylinder, with its roller and pressure bar, are raised on an angle by two screws, operated by connected gearing, so as to retain the proper function of the belts. The pressure bar over the under cylinder also moves up with the upper cylinder, and is swung on hinges, to be easily removed when access to the upper cutter is necessary; it has also a separate adjustment to regulate the pressure. The bed and under cylinder are upon the same plane, and stationary, so that when adjustments are made for different thicknesses of lumber there is no difference to be made for the hight of the feeding-in table. The lower cylinder has an independent adjustment to regulate the thickness of the cut taken from the lower side of the lumber. Both the end of the machine and the pressure bar over the lower cylinder are hinged, and can be swung entirely out of the way without the necessity of removing bolts, for convenience of sharpening the cutters or removing the lower cylinder.

This machine is the subject of several patents, the last two being granted by the Patent Office in October, 1878, and April, 1879. Messrs. J. A. Fay & Co. guarantee this machine as being capable of dressing from 50,000 to 60,000 feet of lumber per day. For further particulars address the manufacturers, as above.



IMPROVED DOUBLE CYLINDER TRAVELLING-BED SURFACING MACHINE.

Peremptory Destruction of Adulterated Articles.

The papers report that the magistrates of Zürich, Switzerland, have made a very energetic *razzia* upon dealers who have been detected selling falsified wines. Whole barrels of such deleterious liquids were rolled down to the lake, accompanied by policemen, and amid the huzzaing of a crowd of lookers-on.

The Swiss wines have just commenced to earn a reputation, and can now be found at stores and restaurants in New York city, and in some other of our large cities, and the Swiss authorities are doing a good work by checking adulteration, which may not only be deleterious to health, but also ruin an incipient and promising industry.

In the same paper we read that the New York Board of Health made a raid on a steamboat which brought milk to the city, and after testing every can by the lactometer, allowed only those which could stand the test to be delivered to the dealers, while the others were emptied into the North River. Among the latter was one belonging to a farmer who boasted that his milk was undiluted with water. Unfortunately for him, when one of his cans was opened, a frog was seen swimming in the milk. How it got there he did not explain; it surprised him disagreeably, and the milk, of course, went overboard with the rest, while the empty cans were returned to the farmers, who in this way have received a serious lesson. They find that it does not pay to send milk that is *too largely* watered to New York city.

Comparative Strength of Explosives.

The report of the United States Board of Army Engineers, just published, presents the following interesting table as the result of two years' thorough trial of the relative efficiency of the various modern explosives, taking ordinary dynamite as the standard:

Dualin	111
Hercules powder, No. 1	106
Dynamite, No. 1	100
Rendrock	94
Gun cotton	87
Dynamite, No. 2	83
Hercules powder, No. 2	83
Mica powder	83
Vulcan powder	82
Nitro-glycerin	81
To which we may add for comparison,	
Blasting gunpowder, No. 1	30

Sanitary Construction and Arrangements of Dwellings.

BY PROF. W. H. CORFIELD, M.A., M.D.

The air in our houses is rendered impure in various ways, but chiefly by our respiration, and by the products of combustion that are allowed to escape into it from lights and fires. The air that we expire contains a certain quantity of foul or putrescent organic matter. It is charged with moisture, and contains about five per cent less oxygen, and nearly five per cent more carbonic acid than the air that we inspire. It is neither the diminution of oxygen nor the increase of carbonic acid in the air of rooms that is of the greatest importance to living beings, but the accumulation of foul organic matter, and the excess of moisture. It is this which renders such atmospheres stuffy, and not the diminution of oxygen or the increase of carbonic acid, which are so slight as to be of little importance, even in overcrowded rooms. Nevertheless, since the increase in carbonic acid is proportional to the increase in other impurities, and since we can estimate very accurately the amount of carbonic acid in the air, the increase of carbonic acid is taken as an index of the impurity of the atmosphere. The average amount of carbonic acid in the outer air is four parts in 10,000. Prof. De Chamont found by his experiments, that whenever the amount of carbonic acid in the air of a room exceeded the amount in the outer air by more than two parts per 10,000, the air of the room was not fresh—that is to say that the foul organic matter in it and the excess of moisture were sufficient to make the room stuffy; hence, two parts of carbonic acid per 10,000 of air over and above that in the outer air, are taken as the limit of respiratory impurity. As an adult breathes out, on the average, 6 cubic feet of carbonic acid in ten hours, it is clear that, in order that the air of the room in which he is may be kept fresh, he must have 30,000 cubic feet of air in the ten hours, or 3,000 per hour. In this climate we cannot change the air of a room more than three or four times per hour without causing draughts, and so each person ought to have from 750 to 1,000 cubic feet of space, the air of which should be changed three or four times per hour respectively. The way in which this space is arranged is also a matter of some importance. For instance, the air above a certain hight is of little use for purposes of ventilation if combined with too small a floor space. To take an extreme case—a man standing on a square foot of ground, with walls 3,000 feet high all around him, would be in 3,000 cubic feet of space; but it is quite obvious that he could not live in it. But, even without any inclosure at all, and without any limit as to hight, it is not difficult to conceive a place overcrowded. For instance, all the inhabitants in the world—men, women, and children—could stand upon the Isle of Wight; but it is quite certain that they could not live there, even if it were only for the want of air. So it is usual, in estimating cubic space, to disregard the hight above 11 or 12 feet. It is also obviously of importance that the floor space should be properly distributed; but about this, so far as dwelling houses are concerned, there is no need to enter into particulars. We are not able to insist on anything like 1,000 or 750 cubic feet of space in all instances, and amounts varying down to as low as 300 cubic feet per individual are adopted. In the case of a family living in one room, which is so small as to afford less than 300 cubic feet per individual, it is usual to consider that the limit of overcrowding which should be allowed by law has been reached. We cannot have, as a general rule, rooms so large that the air does not require changing while we are in them. Thus, for instance, a person in a bedroom for seven hours consecutively requires about 21,000 cubic feet of air if the atmosphere is to be kept fresh. Supposing him to have this without change of air, he would require a room, say 70 feet long by 30 wide and 10 high. This makes it quite clear that in rooms such as we have there must be a change of air.

In studying ventilation from a practical point of view, the chief agents that we have to consider are the winds and movements produced in the air by variations in its density, usually brought about by variations in its temperature; the property of the diffusion of gases by means of which the air is brought to a uniform composition when the temperature is the same throughout, being one which, practically speaking, does not affect the question much. With artificial methods of ventilation, in which the air is forced in a certain direction by machinery, we have little to do, as few of them are suitable for use in dwelling houses. The wind, as an agent of ventilation, is powerful, but its disadvantage is that its action is irregular. When all windows and doors can be opened, a current of air which may be imperceptible is quite sufficient to change the air of a house in a very short time, and houses that have windows on both sides are for this reason more healthy than houses built back to back, which can never have thorough ventilation. This is the direct action of the wind, which may generally be utilized in large rooms with windows on opposite sides, like schoolrooms, by opening that which is nearest to the direction from which the wind comes, a little way at the top, and also opening the one which is diagonally opposite to it, at the top a little further than the first one. The direct action of the wind has also been utilized for ventilating large houses by Silvester's plan, which consists in having a large cowl, that always faces the wind, at the top of a pipe leading down into cellars and the basement of the house, where the air can be warmed by stoves and allowed to ascend into the house. By this plan the holds of ships are frequently ventilated. But the aspiring action of the wind is, perhaps, of greater importance. When the wind blows over the top of a chimney, or over a ventilating pipe, it causes a dimunition of pressure of the column of air in the chimney or ventilator, and so produces an up-current upon precisely the same principle as little bottles made for distributing scent about apartments act. For this reason it is important that chimneys should be higher than the surrounding buildings, so that any wind that blows may cause or increase an up-draught in them. In this way not only is smoke prevented from ascending into the rooms, but the amount of air carried through rooms up the chimneys is increased, and the ventilation of the house improved. There being, then, in every house, and frequently in every room, a shaft for the escape of air, it becomes of the first importance for us to consider the means by which air may be admitted into our houses and into our rooms. In summer, and whenever the air is as warm outside the house as inside of it, there is no difficulty about this. We have only to open the windows—wind doors, remembering the proverb that "Windows were made to open and doors to shut"—on both sides of the house, and the air is generally changed fast enough; but it is in winter, when the air is colder outside than inside, that the difficulties arise, and so in speaking of ventilation I shall always assume that the air outside the house is colder, and therefore heavier, and exercises greater pressure than the air inside it. This being the case, it follows that if we open a window, or make an aperture through a wall into the outer air, or through the wall of a room into a passage or staircase, in which the air is colder than it is in the room, air will come in. In fact, a room under these conditions may be looked upon as if it had water outside of it, and it is quite apparent that, in such a case, if you bored a hole through the wall to the water on the other side, water would come in, and the air of the room would escape by the chimney. This is precisely what happens with the cold air outside. If no special opening is provided through which the cold air can come into a room, it enters through such openings as there are; by the apertures between the sashes of the windows, by the (perhaps fortunately) badly-fitting doors, crevices in the floors, walls, and cupboards; through the walls themselves, as has been shown by Pettenkofer, and sometimes down the chimney. If, then, air will come in through an aperture placed in any position, it becomes necessary to consider where apertures should be placed, and what precautions are necessary with regard to them. Theoretically, the admission of pure air should be at the lowest part of the room, and the extraction of the vitiated air, which is warm, at the upper part of the room; but practically the outer air cannot be admitted, without certain precautions, at the lower part of the room by mere apertures, as everybody knows who has been accustomed to sit in a room when a draught comes under the door. On the other hand, if an aperture is made into the outer air through a wall at a few feet from the door, the air enters in a cold straight current for some distance into the room. If the aperture be higher up, it comes in and falls, just as water would do, on to people's heads, somewhere about the middle of the room. So it is quite clear that certain precautions are necessary in the admission of air so as to prevent draughts. Since we have, or ought to have, windows in all rooms, it will be convenient to consider, first, the ways in which they may be utilized for the admission of air. We cannot simply open a sash window at the top or bottom in cold weather without feeling a draught; but there are several ways in which this difficulty may be got over. The simplest is by placing a board of wood underneath the lower sash, as suggested by Dr. Hinkes Bird. This board is sometimes made with a hinge in the middle, so that it can be got in and out more easily; or the board, instead of being placed under the lower sash, may be placed across, from side to side, in front of the lower part of the lower sash, so that the lower sash may be opened to a certain hight without any air coming in below it. These boards may be covered with green baize, or some other suitable material, so as more perfectly to prevent the entrance of the air at the lower part of the window. In either case, the bars of the sashes at the middle of the window are no longer in contact, and air comes in at the middle of the window, between the two sashes, taking an upward direction, in the form of a fountain, and producing no draught. This shows us the direction in which cold air ought to be admitted into a room—after the fashion of a fountain, in which it can be readily obtained, owing to its greater pressure, and not after the fashion of a waterfall. This simple plan, which I recommend very strongly for adoption, has two disadvantages, one that nervous people always fancy there is a draught if they see anything like a window open, and the other a much more practical one, but one that is common to most forms of ventilation that are inexpensive—that a certain quantity of soot enters. These conditions are, to a certain extent, overcome by the plan suggested by several inventors—of boring holes through or cutting pieces out of the lower bar of the upper sash. Such holes are not seen, and the air comes through them in a vertical direction into the room.

They can also be fitted with little boxes containing cotton wool, through which the air will be filtered and deprived of soot, etc.; this of course very considerably diminishes the amount of air that enters, and the cutting also weakens the framework of the window. I may here mention Currall's window ventilator, which consists of a metal plate fastened along the lower bar of the lower sash, and parallel to it, with an opening below the sash for the admission of air, which is thus deflected into a vertical direction by the metal bar. Here will be also a convenient place to mention the automatic sash fastener patented by Messrs. Tonks & Sons, by means of which the window is securely fastened when opened to the extent of three or four inches, either at the top or bottom, so that the window can be left open without any one outside being able to open it further. This can also, obviously, be combined with the window block placed underneath the lower sash, so that air can be admitted in the proper direction, and the window still be securely fastened. Louvered ventilators may also be used in a variety of ways in connection with windows. Where there are Venetian blinds, it is only necessary to open the top sash, pull the Venetian blinds down in front of the opening, and place the louvers so that they give the entering air an upward direction. Glass louvers fixed in a metal framework may also be used, a pane of window being taken

out and one of these ventilators substituted for it. The louvers can be opened and shut by means of a string, and they are so fixed that it is impossible to break them by doing so. They are generally fixed instead of one of the top panes of the upper sash. It is better to place them lower down in the upper sash, and this is true of all inlets of air. If they are too high up, the air, being admitted in an upward direction, impinges against the ceiling, rebounds into the room, and produces a draught. The metal framework of these ventilators requires oiling and attending to, or it will get rusty. In some places fixed louvers of wood, or still better, of strong glass, may be fixed with advantage, or swinging windows with sashes hung on centers may be used, as, for example, in water-closets; and these, where it is advisable, may be prevented from being closed by means of a small wedge of wood screwed to the framework. The blind so often placed across the lower part of a window, may also advantageously be used as a ventilator, or, where no blind is required, a glass one may be used, this being made to swing forward on its lower edge, so as to give to the entering air an upward direction when the lower sash is opened. Where very large quantities of air require to be admitted, one or more sashes of a window may be made to swing forward in this way. Near to all windows, in cold weather, the air of the room is colder than at other parts of the room. This may be obviated, when considered advisable, by the employment of double windows the layer of air between the two windows preventing, to a very considerable extent, the cooling of the air inside the room. It is not advisable to have double panes of glass in the same sash, as the moisture between them will render them more or less opaque in certain states of the weather. With double windows, air may be admitted by opening the outer one at the bottom and the inner one at the top.

(*Continuation next Month.*)

Spontaneous Combustion Again.

A recent fire on board the steamship "Mosel," which threatened to destroy the vessel, has aroused the fire insurance underwriters in New York, and they have again looked up the information they obtained on this subject a few years ago, and to which we contributed our share. This information was that vegetable oils oxidize so rapidly that when they are diffused through any fibrous substance they create heat; that the presence of moisture aids in the development of heat. Further, that petroleum oils are of a different character, and do not oxidize. Silks of the cheaper grades are peculiarly liable to generate heat, on account of the oil and other substances used in weighting. There is a kind of oil obtained from South America, extracted from a nut, which is always regarded as dangerous. Petroleum, although it does not oxidize, is to be guarded against on account of its volatile qualities; it evaporates rapidly, and the vapors are inflammable.

The fact recognized is that any substance that diffuses itself so rapidly as to cause oxidation, requires only a little increase of heat to make a flame. Even the temperature of the body will do this, and when moisture is added, combustion will take place more rapidly.

No fact is better established than the liability of black dyes to generate heat. Where these are used it is impossible to estimate the hazard, any more than in calculating "moral hazard." In Philadelphia manufacturers often dye their cotton before it is carded, and afterwards mix it with wool, thus introducing oil. The danger arising is necessarily recognized in fixing the rates of insurance. In Leroy street, two or three years ago, flames broke out in a case of silks. Black dyes (in combination with oil and moisture) are undoubtedly a source of mischief, as the records of dye houses throughout the United States show that fire has originated hundreds of times in black dyes, and insurance companies have paid losses far in excess of any rate ever obtained to cover them. Property of this kind is written in these demoralized times at 1@1¼, or far below former rates, and are not looked upon as yielding any profit.

John Wise, in his "History of Aeronautics," states a case of spontaneous combustion in one of his balloons which had been put aside after the silk had been oiled and varnished. The silk generated heat, the greater part of the fabric was rendered useless, and the house in which it was stored narrowly escaped destruction by fire.

Twelve years ago fire insurance companies were not fully aware of the dangerous nature of petroleum vapor, and lost largely by insuring petroleum distilleries and storehouses at too low rates; then a reaction came, and we had to fight against the idea that the heavy, almost non-volatile petroleums used for lubricating purposes, were more dangerous than vegetable and animal oils used for the same purpose. The fact is, that the latter, being unstable compounds, subject to change, are very much inclined to spontaneous combustion, especially among oily rags used for cleaning, while petroleums, being perfectly stable compounds, will, under no circumstances whatever, exhibit the least tendency that way. In reality, if petroleum could possibly become oxidized, which in common language is called rancid, it would have become so long ago, as it is millions of years old, while all other oils and fats are very young, and, comparatively speaking, products of a day, and consequently subject to change, as they were formed by rapid changes during the combination of their constituents.

Desirable Economy of Coal.

If we consider that the mechanical equivalent of one unit of heat is 772 foot-pounds, it follows that we should be able to produce a horse-power, or 33,000 foot-pounds per minute by means of 33,000 : 772 or 43 units of heat spent per minute, or $60 \times 43 = 2{,}580$ units per hour. As one pound of American coal, burned under favorable conditions, will produce 14,000 units of heat, every ounce of coal will produce 14,000 : 16 or 875 units. This is one-third of 2,580 units of heat theoretically required for a horse-power per hour; so that with 3 ounces of coal we ought to be able to produce 3×875 or 2,625 units per hour—more than enough for one horse-power.

What is now actually the case in practice? The very best steam engine on record requires 1¾ pounds of coal per horse-power per hour, which is 9 times as much, and only 11 per cent of the actual heat-power contained in the fuel. This, though a large proportion of loss, can probably never be overcome. The importance of the inquiry is evidenced by the fact that every 1 per cent gained means, in the consumption of coal in England alone, a saving of about half a million tons per annum.

Mr. E. Bainbridge stated in a paper read before the British Association, that about 50,000,000 tons are annually used in the production of steam, which is about 37 per cent of the whole output. The coal used in dwellings, great as is the waste, is more fully utilized than when it is used in any other way; thus 13 per cent of the heat actually possessed by fuel is given off in an open fire-place. The author then gave the results of an experiment he had made with the winding engine and boilers of a small colliery, such plant being nearly thirty years old. Some of the improvements which might be made with a view to promote economy of fuel, were the fixing of boilers of an improved construction, with a minimum thickness of plates and a maximum area of heating surface; special attention should be paid to the manner in which air is admitted to the fire and to the working of the damper; the air intermingled in the fire grate should be so intermingled with the gases from the fire as to enable a minimum quantity of air to be used; the application of such form of fire grates and such mode of firing as will enable the cheapest quality of fuel to be used; the complete covering of all exposed hot surfaces; where water is scarce, the application of the best form of water heater; where water is plentiful, the adoption of an improved form of condenser; steam jacketing of the cylinder and mechanical accuracy in the construction of engine; the application of the system of variable expansion when the work done by the engine varies; in case of winding engines, the adoption of drums of varying diameters; as a general principle, the use of steam at a high temperature, in order to have the greatest possible difference in temperature between the steam when it reaches the cylinder and when it has done its work. In the application of such improvements to ordinary steam engines, the saving in working cost must, of course, first be considered, and in the adoption of all such means of promoting economy as have been alluded to, it may be confidently asserted that the saving in working cost will, as a rule, wipe out the extra first cost incurred in a very short time, since the saving effected will probably vary from 50 to 150 per cent per annum on the first cost.

Another Competitor to British Industry.

The prospect of Great Britain regaining the lost ground in furnishing the world with the products of industry needed, looks very gloomy indeed. Thus far England possessed almost a monopoly in this line, until in the West a formidable rivalry developed—namely, in the United States. Recently an equally formidable rival has sprung up in the East—Japan.

A letter was lately received by a large manufacturing house in Birmingham, England, from its agent in Yokohama, and published in the *Engineer*, from which we make the following extracts. The agent says: "The Japanese are now making a number of articles which I formerly purchased from you, at prices beyond the possibility of European competition. In fact, quite a number of various classes of merchandise are being made in this country, and Europeans are obliged to discontinue in consequence. Since I last wrote you, I have been offered a large order for your goods, but at a price at which I should lose about 10 per cent; yet a factory at Osaka has taken the order, and is now making the goods."

The writer says further that the Japanese are able to undersell every labor market which they enter and outdo every civilized artisan at his own trade. They are always ready to learn and to outvie everything that the West does, and this they do with less food, less air, and less clothing than any civilized workman. It is the conviction of the agent of this Birmingham firm that the Japanese "will become formidable rivals of all kinds of Western manufacturers." It may be added that in Japan the import duties are only 5 per cent *ad valorem* on the class of merchandise to which this letter refers.

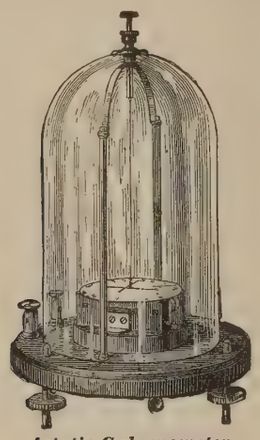
What Japan threatens to do with cheap labor, we do with improved machinery; what the Japanese do by economy in the needs of the workman, Americans do by means of exuberance of brain—the power of inventors.

The Great Eastern in Use Again.

The owners of the "Great Eastern" have resolved to fit that gigantic vessel for the transport of live cattle from Texas to London. The necessary changes will cost two and a half million francs, or half a million dollars, including new steam boilers, as the old ones from the first have been found to be of inferior design and of insufficient capacity. It is confidently expected that the enterprise will pay, as it will be possible to transport at least 2,000 head of cattle, or 36,000 sheep at each trip. If any of our readers think that this is a rather large number, we remind them that the "Great Eastern" has a much larger capacity than Noah's ark had, and besides is far superior in regard to workmanship and ventilation. The ark had only one door and one window. That the workmanship of the ark must have been inferior is a natural consequence from the fact that Noah had not at his command the facilities afforded by the English ship-yard where the "Great Eastern" was built, nor did he have so able and experienced a body of workmen at his command.

Astatic Galvanometers.

The adjoined engraving represents what is called an Astatic Galvanometer, as made by Elliot & Co., of London. Like all very delicate instruments of this class, it is protected by a glass shade, so as to prevent the needle from being moved by air currents, which affect it very readily on account of its being astatic, which means that it is double, or rather consists of two compass needles fixed, with reversed poles, to one axis. As the directive force of two such needles is never perfectly alike, the stronger one will overcome the weaker, which will therefore be compelled to point with its north pole southward. Parallel with the needles are two flat coils of fine isolated copper wire, one at each side, and so close together as only to allow the lower needle to be placed between, while the upper needle is above the coils, which are covered with a graduated dial plate, over which the upper needle turns, and on which the degrees of deviation are read off. As the compass needle places itself always across the currents, these needles will do the same, and as the deviation of a needle above a current is in an opposite direction to that below the current, the needles would counteract one another if they were attached with equal poles in the same direction; but this not being the case,



Astatic Galvanometer.

the upper needle will turn in the same direction as the lower one, and in this way such a delicate sensitiveness is produced that these galvanometers will indicate traces of electric currents not perceptible at all with less delicate contrivances. In fact, this kind of galvanometer is altogether too delicate for ordinary use with galvanic batteries, and is more largely used for detecting whether currents are present under certain circumstances, when there is doubt regarding their existence.

Every philosophical cabinet possesses some instrument of this kind, if not several of them, of various degrees of sensitiveness, and we will only add that few instruments are more useful or more easily constructed. Almost any one can make one, by procuring one of the smallest kinds of glass shades on a foot, and fixing on the foot a coil of isolated wire, with two magnetized pieces of watch-spring properly connected, and suspended by a cocoon silk thread; a paper graduated scale completes the whole arrangement. We state this from experience, having made one in the manner here described more than fifty years ago, and this galvanometer, notwithstanding crude in its construction, proved to be so delicate and serviceable, that we still frequently use it in preference to more finished instruments.

A CURIOUS ACOUSTICAL ILLUSION.—M. Plumaudon, of the Puy de Dome Observatory, has pointed out a curious acoustical illusion, which some of those who use a pair of telephones in receiving may have observed. With a single telephone held, say to the right ear, the transmitted voice appears to come from a distance to the right; while with a telephone held to the left ear, it seems to arise from the left of the listener. With a telephone to each ear, if one ear be less sensitive than the other, or if the telephone be held farthest from that ear, the voice shifts to the side of the other ear; and if both ears hear alike, and both instruments are equally near their respective ears, the voice apparently proceeds from in front of the observer.

The Extent of British Possessions.

Mr. Baden Powell, of London, read a paper before the Social Science Congress, recently held in that city, advocating a free trade union of all the countries subject to Great Britain. He says that with the proposed union realized, no power in the world would contain within inself such a positive assurance of future prosperity and progress. He says: "Ancient Rome, at the zenith of her greatness, never possessed more than one-sixth of the territories owning our sway, or one-half the population. The numerous races of these lands, as they grow in number, owing to their varying degrees of civilization, will in the future form the source of an enormous commerce that would sustain this country though every other nation should close its ports against our ships, while the wide territories over which they are scattered offer every variety of climate to the selection of our emigrants, and are capable of beneficially absorbing the surplus population of this country, even if they depart from our shores by millions."

To demonstrate this, the *Textile Manufacturer*, of Manchester, appends the following particulars, compiled from good sources and the most recent statements. They will give the reader a correct idea of the possessions, area, and population of the British empire, exclusive of any interests in Cyprus, Afghanistan, or the Protectorate of Turkey:

Possessions.	*Area. Square Miles.*	*Population.*
EUROPE—		
British Isles	122,550	33,089,237
Heligoland	5	1,899
Gibraltar	2	16,454
Malta and Gozo	115	141,918
ASIA—		
British India	897,004	189,613,238
India Feudatory States	589,315	50,325,457
Ceylon	24,702	2,418,741
Straits Settlements	1,225	308,097
Hong Kong	32	121,985
Aden	3	3,418
AFRICA—		
Gambia	21	14,190
Sierra Leone	468	55,373
Gold Coast and Lagos	6,000	468,291
Transvaal	114,440	250,000
Cape Colony	200,610	566,158
Natal	18,750	307,241
Griqua Land West	17,800	—
Mauritius, Amirantes, and Saychelles	1,000	339,371
St. Helena	47	6,241
Ascension	35	—
AMERICA—		
Nova Scotia	21,731	387,800
New Brunswick	27,322	285,594
Quebec	193,355	1,191,516
Ontario	107,780	1,620,851
Manitoba	14,340	11,853
Northwest Territory	2,750,000	28,700
British Columbia and Vancouver's Island	220,000	50,000
Prince Edward's Island	2,156	94,021
Newfoundland	40,200	145,537
Bermudas	18	12,121
Honduras	13,500	24,710
West India Islands	9,421	550,039
Windward Islands	777	286,967
Leeward Islands	640	118,078
Trinidad	1,754	119,638
British Guiana	76,000	193,491
Falkland Islands	7,600	933
OCEANIA—		
New South Wales	325,000	584,279
Victoria	88,198	808,437
South Australia	914,730	204,623
Western Australia	978,299	26,209
Queensland	678,600	163,517
Tasmania	26,215	104,176
New Zealand	105,000	341,860
Auckland Isles	10	—
Norfolk Isles	10	—
Labuan	45	4,808
Fiji	7,404	142,286

Mr. Powell adds: "A review of these territories will show that England is not quite at the mercy of foreign powers for either corn, cotton, wine, or oil for her own consumption, or that she will lack outlets for the products of her industry. The energy of all the people of this country is quite capable of doing anew in the above lands what it has done previously in the United States; and if the latter country chooses to continue its present restrictive commercial policy, the day may not be distant when our supplies of cotton, corn, and animal food will be drawn exclusively from our own territories, or at least other fields than hers."

Thomson's Double Coil Galvanometer.

We represent here a refinement of the astatic galvanometer as improved by Sir William Thomson. It has two coils, one above the other, exactly alike in their effect upon the compass needle, situated in the middle of each. These needles are connected with reversed poles, while the upper one carries a mirror, which reflects a beam of light. A bar magnet, seen above, serves to give direction to the needles, and may

Double Coil Galvanometer.

be moved up and down, so as to nearly neutralize terrestrial magnetism if desired. The connections at the base serve to use the coils in combination, either as acting together or counteracting one another.

Different kinds of these instruments are used, some with very fine and long wire, for delicate currents, and some with short heavy wire, for strong currents. These kinds of instruments are used for telegraphing, especially through long submarine wires, such as across the Atlantic ocean.

TROUBLESOME OCTOPODS.—The Leeds *Mercury* says that a rather amusing incident was witnessed in the Scarborough Aquarium recently. The keeper, while engaged in cleaning out the tank occupied by the octopods, was suddenly seized by the leg (fortunately he had sea boots on) by the largest of the octopods, which fastened four of his tenacles round the leg of the boot, and with the other four held firmly on the rocks forming the back of the tank. A struggle ensued, during which the man found he could not disengage himself without killing the animal, and finally hit upon the expedient of slipping his leg out, leaving the boot in the water, and beating a retreat. The hungry octopus stuck to the boot for twenty minutes, when it relinquished its hold. A much more exciting story is reported in the Tokio (Japan) newspapers about a struggle between octopods and a bull, which would have ended fatally for the bull if some men had not interfered by cutting the arms and legs of the monsters.

Measuring the Velocity of the Wind.

The apparatus at present generally used in meteorological observatories to measure and record the velocity of the wind, is represented in the adjoined engravings at one-tenth part its natural size. It consists of two light horizontal bars which cross each other at right angles, and can turn on a vertical axis; at the two extremities of each bar hemispherical cups are attached, in such a manner that the convex or round side of each is turned toward the concave or hollow side of the next—in other words, they are situated in the circumference of a circle, in which, in going around it, the hollows are all turned in the same direction, so that when exposed to an air current the wind always strikes against two concave or hollow hemispheres, and against two convex or round ones.

Our engravings represent the apparatus in perspective, as seen from below. The cup A, Fig. 1, is nearest to the observer and C the farthest off, while of B he sees the hollow and of D the round side; a circle connects the rods, in order to strengthen their attachment to the axis. It is self-evident that the wind must exert more pressure on the hollow sides of the cups than on their round sides, along which it glides off easily, while the hollow sides tend to retain it, and that consequently a rotary motion must result. The French inventor of this device—M. Robinson—has proved that the number of revolutions of such a mill is always proportional to the velocity of the wind, however great that may be—in other words, that the velocity of each of the hemispheres is always a constant fraction of the velocity of the wind. Experience has proved that if the apparatus is delicately constructed, so as to reduce all resistance by friction to a minimum, the friction referred to is one-half, so that the balls move with half the velocity of the wind; but that if more strongly made, so as to withstand hurricanes, and having a recording device attached as represented in Fig. 2, the resistance becomes greater, and the number one-third is sufficiently correct for all practical purposes, so that in order to find the direct velocity of the wind we have only to multiply the length of the circumference of the circles which the balls pass over, by the number 3.

The apparatus as described may be seen in constant operation on the top of any of our weather signal stations; for instance, on the Smithsonian Institution at Washington; on the highest part of the Equitable Insurance building, Broadway, New York; and we even find it on the top of Mount Washington, New Hampshire, and on Pike's Peak, Colorado. On reaching the top of one of those buildings, and submitting the contrivance to a closer inspection, a little box G (Fig. 1) is seen under it, of which the interior arrangement is represented on a larger scale in Fig. 2. It is intended to make automatically and continually a record of the number of revolutions of the machine, by help of the electric telegraph.

The axis M, Fig. 2, passes through the tube E, and carries at the lower end a screw which acts on a toothed wheel R, having 100 teeth. Every revolution of the axis, therefore, causes the wheel to advance one tooth; at every half revolution of the wheel, corresponding with 50 revolutions of the instrument on the top, the toothed wheel closes the circuit of a telegraph battery, by means of two little pivots *a a* touching a brass spring S; the current passes and acts on an electric registering instrument in the cabinet of the observer, which may of course be at quite a distance in case this is found convenient. The registering instrument consists of an old-fashioned Morse electro-magnet, in which a point makes a mark on a long strip of paper, travelling by clock-work at a constant speed over a small drum. Every time the circuit is closed by the half revolution of the wheel R, corresponding with 50 revolutions of the little mill, a mark is made, and these marks will be close together in proportion to the velocity of the wind. A very simple calculation, based on previous experiments, made once for all time, gives the exact speed of the air current to which the instrument is exposed.

The above described arrangement does not give the only method by which the velocity of the wind can be measured; there are others in use, and several more devices are possible which have not yet been executed. The general name under which these instruments, designed to observe and measure the velocity of air currents, are designated as "Anemometers."

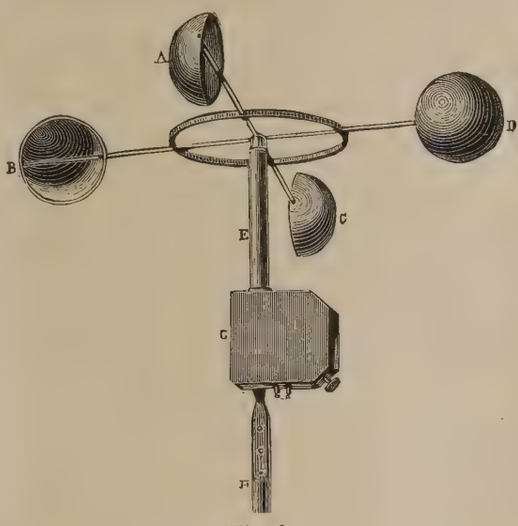


Fig. 1.

M. Renou, a noted French meteorologist, suggests a square plate of say a foot or a yard in surface, sus-

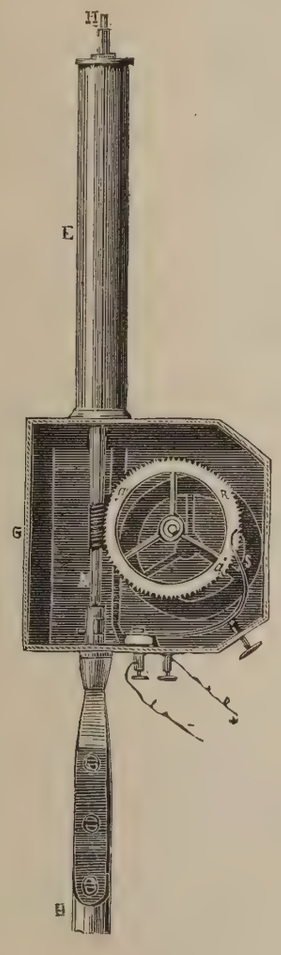


Fig. 2.

pended from its upper side, as on a hinge. The wind would cause it to deviate from its vertical position, which it would possess only when there were no wind. This very simple device has never been applied, for the reason that the plate will continually oscillate; but this could easily be overcome by attaching to the lower side of the plate a metallic rod, connected below with a set of plates plunged into water, and so shaped as to present the greatest possible resistance to oscillating motion. The wind presses the upper plate from its vertical to an inclined position, and it will remain at an incline which is the mean between the oscillation of a plate not provided with such an attachment. Theory and experiment both prove that the pressure of the wind in pounds is proportional to the tangent of the angle which it moves the plate out of the vertical direction, and which angle can be read off on a graduated scale, with which the plate is provided. This scale may also contain the coefficients of friction and the limits of the deviation of the plate. An automatic registering device could also be easily applied.

Another arrangement which has been used, is a spring, the resistance of which has been measured in pounds, which, being placed behind a vertical plate, is pressed backward by the force of the wind. The amount of compression of the spring for every number of pounds being known, it has only to be observed to find at once the amount of wind pressure.

For a direct method of measuring the velocity of the wind, M. Renou proposes the use of small rubber balls, filled with gas in such a way as to have the same specific gravity as the air, as thus neither to ascend or descend, but to travel horizontally; then to attach one of these to a fine thread of cocoon silk of say 100 meters long, and then to observe how long it takes it to go over this distance and stretch the thread.

Observations of the latter kind, compared with the instrument described which gives the pressure of the wind in pounds, have shown the amount of pressure as corresponding with various velocities of wind, and which are embodied in the following table, representing, in round numbers, the relation near enough for all practical purposes:

A pressure on a square foot of surface.	*Corresponds with a velocity of wind.*
1 ounce	3½ miles per hour.
2 ounces	5 " "
8 "	10 " "
2 pounds	20 " "
4.5 "	30 " "
8 "	40 " "
12.5 "	50 " "
18 "	60 " "
32 "	80 " "
50 "	100 " "

The first number in the table represents the most gentle breeze, and the last the most violent hurricanes ever known.

White Brick.—A process is now being carried out, by Clarke & Pickwell, Hull, England, for the manufacture of white pressed brick, from common red clays. This process consists in mixing or grinding into the common clay a cheap material—chiefly magnesian limestone—which has been reduced to an impalpable and harmless powder by being burned and slaked. This mixture is passed through a series of mixing and grinding mills, and so completely ground that each particle of each ingredient is brought into close contact with each other. This mixture is then acted upon as it leaves the last mill by an apparatus which reduces it to a fine grain almost like running soil; in this state it falls through the feeder into the molds of powerful steam-pressing machine, is subjected to a heavy pressure, and is delivered at the delivery table a complete and almost dry pressed brick, which when burnt in the kiln, produces a white brick of good quality. The ingredients added to the clay at once absorb about forty per cent of the moisture found in the natural clay, and the grinding is so close and complete that the mixture is thoroughly and evenly amalgamated. The change effected in the color of the red clay on being burnt is due to the presence of the mixture.

Scientific.

DISCOVERY, THE MOTHER OF INVENTION.—It is curious to note how frequently writers confound the words "discovery" and "invention." Thus quite recently an English contemporary spoke of the discovery of the sewing machine in the United States, and we have frequently seen statements about the "discovery of the art of printing," the "discovery of the steam engine," etc. Now, any large dictionary will show that "to discover," is to bring out a thing which existed before, but which was unknown; while "to invent," is to produce something new which did not exist, or a combination which produced results by means unknown before. Thus, Benjamin Franklin discovered that thunder and lightning were produced by electricity; Prof. Henry discovered the laws of induced or secondary currents; while Morse invented the application of electricity to telegraphy; Bell invented one form of speaking telephone, and Edison invented the phonograph.

When analyzing the details of various inventions, we find that they are based on previous discoveries; hence we may call "discovery the mother of invention," and this on just as good grounds as the common saying that "necessity is the mother of invention." In fact, there is probably not an art, process, or manufacture which is not largely due to scientific discovery; and if we trace them back to their source, we nearly always find them to have originated in scientific research. The great pecuniary benefits arising from the application of science are generally reaped in the first instance by all great manufacturers, agriculturists, merchants, and capitalists. Countless fortunes have been made by means of processes and manufactures based upon scientific discovery. In a general way, however, the greatest pecuniary benefits arising from science, sooner or later go to enrich the possessors of land.

Discovery having been in most, if not in all cases, the mother of invention, we come to the conclusion that among the most important modern inventions those based upon new discoveries are far more important than those based upon knowledge acquired long ago. A man cannot invent an improvement unless he possesses scientific knowledge. The discovery of a single substance, such as oil of vitriol, or a washing soda, has led to the formation of many inventions, patented or otherwise. Nearly every manufacturer in this country is deriving, from scientific discoveries, advantages from which there has been little or no reimbursement to the discoverer. For instance, the makers of coal tar and the dyers of wool and silk are using the discovery of nitro-benzin; manufacturers of picric acid and French purple have enjoyed the fruits of the labors of a well-known Englishman; the various telegraph companies, copper smelters, and makers of copper wire are using the discovery of the influence of impurities on the electric conducting power of copper. The makers of electro-plate and of German silver are deriving great profits from the labors of Faraday; makers of Bessemer steel enjoy advantages derived from the spectrum discoveries of Fraunhofer, and their application to the invention of the spectroscope by Bunsen and Kirchoff; iron and copper smelters, metallurgists, dyers, calico printers, bleachers, brewers, makers of vinegar, white lead, varnishes, colors, soaps, phosphorus, oil of vitriol, and many others, are deriving benefits from the discoveries of Priestley. Added to all this, there are the pecuniary advantages of the use of even only a few of these scientific discoveries where gains are enormous.

There is perhaps scarcely a person in the whole civilized world who has not derived some advantage, in one way or another, from scientific research. For instance, the advantages of gaslight, rapid postal service and transmission of goods, railway travelling, cotton goods, photography, improved medicine and surgery, preserved meats, condensed milk, etc., have been reaped more or less by every one, even the pauper coming within the pale of the advantages. To this must be added the direct advantages which science has given to the army of workmen and artisans employed in various occupations. It is estimated that in the United States alone the results of scientific researches give employment in manufactures alone to 3,000,000 persons, whose wages aggregate $775,000,000, and the products of whose work is valued at $4,500,000,000 per year.

Who, after such exposures, can doubt the importance of scientific research. Discoveries produced inventions, inventions gave rise to processes and manufactures, the employment of workmen, the erection of workshops and dwellings, towns and cities, and increase in the value of land—and all those great additions to the value of land are largely due to the unpaid labors of scientific discoverers; and it may be said that this country, as well as other civilized peoples, have largely gained their wealth by, and are still living in a great degree on, the product of those labors. Therefore, we may state, without fear of contradiction, that the greater portion of the wealth of the United States has been obtained by the application of scientific knowledge to the substances and forces by which we are surrounded. Who does not realize the fact that if the researches of philosophers such as Heron and Watt had not discovered the power of steam, the steam engine would not have been invented, without which railways, steamships, and all the numerous uses to which steam is now applied, would have been comparatively unknown.

The same reasoning applies to many details in the field of discovery. The discoveries of nitric acid, hydrochloric acid, oil of vitriol, and washing soda by alchemists, led to the erection of the numerous large manufactories of those substances which now exist in all civilized countries. The discovery of zinc has led to an improvement in galvanic batteries, and this to the discovery of facts which are the basis of the invention of telegraphy. The discovery of nickel has led to the great modern use of nickel-plated and other articles, and to the invention of many useful alloys, such as German Silver, etc. The discovery of chlorin formed the basis of nearly all our modern processes of bleaching cottons and other fabrics.

There is, in fact, scarcely an end to the list of new inventions and important improvements of old processes which are due to the combined operations of preparatory discoveries and subsequent applications to the various inventions of which we enjoy the fruits.

HYDROGEN AS A CONDUCTOR OF HEAT—AN INTERESTING EXPERIMENT.—The following description of a well-known experiment is going the rounds of the scientific departments of our periodicals: "A very simple method of showing that hydrogen is a better conductor of heat than other gases, which is probably due to its metallic character, is described by Carl von Than. Two strong copper wires, several inches long, are held parallel to each other, but not in contact, by slipping over them two short pieces of glass tube, one an inch from the end, the other in the middle, and filling the tubes with plaster of Paris. The short ends of the wire are bent twice at right angles, so as to be an inch apart at the ends, and are connected by a very fine platinum wire. The wires are kept in a vertical position by clamping the second tube to a retort-holder or other support. The longer ends of the wires are bent apart and attached to the poles of a battery of three or four cells. The wires being insulated from each other, the current passes through the fine platinum wire, heating it red-hot. If a bell-jar of hydrogen be held over it, the wire ceases to glow, because heat is conducted so rapidly away. On bringing it into the air again it begins to glow."

In connection with this we remark, first, that experiments showing that a platinum wire made red-hot in the air by an electric current, will cool down when placed in an atmosphere of hydrogen, is a very old one; second, that the method above described to make the experiment is objectionable, for the reason that when a bell-jar of hydrogen is brought over the wire, the latter comes first in contact with the mixture of air and hydrogen, always present at the lower edge of an open bell-jar filled with hydrogen, forming an explosive mixture which the red-hot platinum wire may ignite, and soon burns up the hydrogen in the jar, bringing the experiment to a premature end.

A better way, and one that we always used when making this experiment before our classes in Physics, (some twenty years ago), was to take a wide glass tube, open at both ends, in which were inserted corks, each perforated with two holes, one for the conducting copper wire and one for a short glass tube, for the inlet and outlet of gases; the conducting copper wires were connected interiorly by a spiral of platinum wire, and one of the glass tubes exteriorly attached to a rubber hose, for the supply of gas. When the platinum spiral is made red-hot by the electric current, and hydrogen is introduced through the tube, the red-hot wire may ignite the mixture of hydrogen and air and blow out the corks, therefore we always first introduced carbon-dioxid (carbonic acid) gas, so as to displace the air with its oxygen; when the tube was filled with this gas and the spiral in full glow, the hydrogen was let in, the heat diminished, and the spiral lost its glowing appearance. By the re-admission of the carbon-dioxid it became glowing again.

The experiment may be varied and made more striking by passing through one of the corks two glass tubes, one for hydrogen and one for carbon-dioxid, when the platinum spiral may be made hot and cold in succession by admitting carbonic acid or hydrogen gas alternately.

MICROSCOPIC DISCOVERY OF MALARIAL POISONS.—For some time past physicians and other investigators have been occupied in ascertaining the poison producing malaria, and at last success has crowned their labors.

The poison is not cognizable by the senses, nor can it be detected by chemical tests. The air of malarial districts has been analyzed, the soil has been submitted to microscopical examination, but no light was thrown on the subject. But not finding a thing looked for is only negative proof, and by no means decisive in any investigation. One thing was certain, namely, that the poison was generated in salt and fresh water marshes, in wet meadows, from vegetation decaying under a hot sun, in lands alternately flooded and drained, in the moving of earth rich in vegetable matter, and in the drying up under certain atmospheric conditions of stagnant pools. But what the poison was that produced those remittent and intermittent diseases which are known by the various names of marsh fever, malarial fever, fever and ague, and popularly as "chills" and "shakes," has at length been discovered by two scientists, Signor Tomasi, of Rome, and Prof. Kleb, of Prague. After spending three weeks in that fever-stricken region, the Roman Campagna, experimenting on its soils, its atmosphere, and its stagnant waters, they have succeeded in seeing the microscopic fungus, which, on being placed under the skins of healthy dogs, caused distinct and regular paroxysms of intermittent fever, and produced in the spleens of these animals that peculiar enlarged condition which is a recognized part of the pathology of this disease.

The report of their investigations and experiments, and the success that crowned them, was read a short time since in the Academy at Rome, and if further tests substantiate the truth of their discovery, the next series of experiments will have for their object the means whereby these poisonous fungi may either be destroyed or rendered innocuous. The practical agricultural remedy of draining and liming will probably remain the best remedy.

The discovery of the source of malaria in a minute fungus, discernible only under the microscope, merits the applause with which it has been received, and will strengthen very materially the belief in the germ theory of disease which has found in Tyndall one of its ablest advocates.

THE TELEPHONE ABROAD.—The disinclination to adopt American institutions not infrequently deprives the people in foreign countries of the benefit of facilities

and conveniences which in the United States are regarded as indispensable. Our system of fire-alarm telegraphs which is here so generally and successfully introduced, has never, we believe, been adopted elsewhere, and the cumbersome and inefficient systems of notifying the existence and localities of fire are retained. The telephone was at once adopted and put to practical and extensive use here, while abroad, except in Germany, very little use has been made of it as yet. The system of telephonic communication which has proved to be so popular, is just being introduced in England and France, but in every instance, we believe, due to American enterprise. It will no doubt require some time, even after they are established, to educate the public to use them to any considerable extent. Perseverance, however, will in time overcome unreasonable prejudice, and we shall probably within a few years see the telephone in use in all the great business centers of Europe. Their advantages are so obvious, and the necessity for prompt communication so pressing, that once introduced they cannot fail to meet with more prompt appreciation and practical adoption as localized institutions than has usually been the case with telegraphic improvements originating in this country.

The Atmospheric Carbon-Dioxid.

CONTINUED FROM PAGE 255.

"Two questions here present themselves in connection with the problem of the earth's climate, from the appearance of terrestrial vegetation until now: 1. Has the mean annual temperature of the globe during this period ever been less? 2. Has it ever been greater than at present? It is shown by paleontological evidence that a very warm or subtropical climate prevailed over the Arctic regions during the carboniferous, triassic, jurassic, and lower cretaceous times, following which, we find in the upper cretaceous a commencement of refrigeration, although until the close of the miocene a vegetation like that now characterizing the middle temperate zone flourished in far northern latitudes. After this came the cold of the pliocene age, which, with some variations, has continued until now. That the Arctic cold has at times extended over certain continental areas farther southward than at present, is undoubted; but this—the mean annual temperature of the globe being the same as now—might result from changed geographical conditions. A new distribution of land and water might bring back the reindeer to France, or give to Labrador the climate of Ireland. More than this, geographical changes are conceivable which, permitting the influx of warm currents into the Polar seas, would create even there an insular climate of exceeding mildness. The studies of Nordenskiöld have, however, shown that a warm climate prevailed there in the carboniferous age over a great area of land, which supported a colossal vegetation not unlike that then flourishing in the intertropical climates of the earth. It is inconceivable that, with an atmosphere constituted like that of the present day, any geographical conditions could maintain during the long winter nights such a climate in insular regions, and still less over a continental area within the Polar circle. We are therefore forced to the conclusion that geographical changes, though a true cause of local variations of climate, and adequate to explain the greater refrigeration of certain areas since the commencement of the pliocene, are not sufficient to account for the warmer climates of previous ages; and we conclude that the cause of these is to be found in the former greater volume and different chemical constitution of the atmosphere, as already set forth.

"This view is opposed to the hypothesis maintained by many geologists of an alternation of warm and glacial climates at the surface of the earth, repeated from the earlier times. Dawson and Heer, however, from the study of the fossil floras found in Arctic regions from the Devonian to the miocene, conclude that paleontology affords no evidence of such a condition of things, and the observations of McCoy, Hector, and Hutton in the southern hemisphere lead them to similar conclusions. The nursery of these successive northern floras appears to have been in the Arctic regions, and their spread southward would, according to Dawson, be due to continental elevations, bringing about, at irregular periods, a cooler climate in the northern temperate zone. It may even be conceived, as well remarked by J. F. Campbell, that such elevations might bring large areas of the earth's surface into the region of perpetual frost, thus giving rise to local glacial phenomena, while a warm climate prevailed everywhere at the sea-level. Nordenskiöld declares that he sought in vain for evidences of ice-action in the various sedimentary deposits of Spitzbergen.

"In regard to a suggested explanation of former climatic conditions, the author may be permitted to quote the following language used by him in 1876: 'Recent speculations have revived the old notion of a possible change of the earth's axis of rotation, as a way of explaining this change of Arctic climate; but such a phenomenon is astronomically improbable, and is also opposed by the fact that the direction of the oceanic currents, which are guided by the earth's rotation, appears, from the distribution of marine sediments, to have been the same since very early periods.' Dawson has since urged the same argument, and reinforced it by recalling the fact that the southward migrations of successive floras, not less than the lines of distribution of mechanical sediments in past ages, show that from early paleozoic time the general courses of the oceanic currents, and consequently the position of the earth's axis, have not changed.

"In connection with the hypothesis of a universal atmosphere may be mentioned a speculation which was put forth by the author in an address delivered by him in July, 1874, at the grave of Priestley, in Northumberland, Pa., entitled 'A Century's Progress in Theoretical Chemistry,' and published in the *American Chemist* for that year, and an extract therefrom, under the title of 'Celestial Chemistry,' appeared in the *Popular Science Monthly*. In that address, after referring to the results of the spectroscopic study of the stars, and to the increase in the chemical complexity of their spectra which appears in passing from the white to the yellow and red stars, it was said: 'If, in accordance with the nebular hypothesis, we look upon these differeent types of stars as representing successive stages in the process of condensation from nebula to planet, we may also see in them a gradual evolution of the more complex from the simpler forms of matter by a process of celestial chemistry. Such was the view put forward by F. W. Clarke, in January, 1873, and some months later by Lockyer, who has reiterated and enforced these suggestions, and moreover connected them with the speculations of Dumas on the composite nature of the elements. . . . I ventured, in 1867, while speculating on the phenomena of dissociation, to remark that, although from the experiments of the laboratory we can only conjecture the complex nature of the so-called elementary substances, we may expect that their further dissociation in stellar or nebulous masses may give us evidence of matter still more elementary.'

"The green line in the spectrum of the solar chromosphere, which has been supposed to show therein the existence of a hitherto unknown gaseous element, was then noticed, and it was added: 'Is it not possible that we have here that more elemental form of matter which, though not seen in the nebulæ, is liberated by the intense heat of the solar sphere, and may possibly correspond to the primary matter conjectured by Dumas, having an equivalent weight one-fourth that of hydrogen? Mention should also be made of the unknown element conjectured by Huggins to exist in some nebulæ. This conception of a first matter, or *urstoff*, has also been maintained by Hinrichs, who has put forward an argument in its favor from a consideration of the wave-lengths in the lines of the spectra of various elements.'

"It is curious in this connection to note that Lavoisier suggested that hydrogen, nitrogen, and oxygen, with heat and light, might be regarded as simpler forms of matter from which all others were derived. The nebulæ, which we conceive as condensing into suns and planets, show us only two of the three elements of our terrestrial envelop, which is made up of air and aqueous vapor. If now we admit, as I am disposed to do, with [Sir William R. Grove and] W. Mattieu Williams, that our atmosphere and ocean are not simply terrestrial, but cosmical, and are a portion of the medium which, in an attenuated form, fills the interstellary spaces, these same nebulæ and their resulting worlds may be evolved by a process of chemical condensation from this universal atmosphere, to which they would sustain a relation somewhat analogous to that of clouds and rain to the aqueous vapor around us. This, though it may be regarded as a legitimate and plausible speculation, is at present nothing more, and we may never advance beyond conjecture as to the relations of the various forms of so-called elemental matter, and to the processes which govern the evolution of the starry spheres."

A Threatened Law-Suit for Telling the Honest Truth.

We learn that the Chambers National Lightning Protection Company, of Cincinnati, which we exposed on page 243 of our November number as an unmitigated humbug, has commenced a law-suit in the United States Court, for $50,000 damages, against J. K. Macomber, Professor of Physics of the Iowa Agricultural College, Ames, Ia., by reason of an alleged libelous attack published in the journal of that college, and in which the learned professor expressed himself as freely as we have done in our article referred to above.

We are also informed that this company had only applied for the patent when they commenced their new so-called patent device, and that very properly the patent has been refused. This is right; by such a course our often so much abused Patent Office, far from sustaining erroneous claims, takes a bold stand and denounces a humbug. We are anxious to see what course this National (?) Lightning Protection (?) Co. will take—whether they will include the MANUFACTURER AND BUILDER in their prosecution. In the meantime we give a letter from the professor named, addressed to our esteemed contemporary the *Nation*:

TO THE EDITOR OF THE NATION:

Sir: In your last number is an article in which you ventilate the "Chambers" lightning-rod swindle, which is of special interest to me. In my endeavors to warn the public against its use, I have incurred the enmity of some of the State papers, as well as of the "Lightning-Rod Company." In a recent issue of the College *Quarterly* I denounced the rod as a "humbug" and a "fraud," and the company has commenced a law-suit against me in the United States Court for $50,000 damages. Hence the proof-slip which I enclose. As you see, the aforesaid rod is not only a "humbug," it is "dangerous," in the opinion of our most eminent scientists. This rod is now in use on several high-school buildings in the eastern part of Iowa, and many others of a private or public character. The agents of the company manage to get endorsements from prominent unscientific persons in each town, buy up the newspaper reporters and get a puff in the paper, and then on the strength of these they manage to swindle all sorts of people. I have seen their "experiments," and they are utterly valueless, and prove nothing at all. Any person at all informed in electricity can immediately point out the errors in the experiments. This is unquestionably one of the most stupendous swindles before the public. I have six different circulars and pamphlets issued by the company, in which I learn that agencies have been established in the Western and Southern States, and in New York. The enclosed proof-slip is an article which will appear in the next *Quarterly*, and I intend to give it such a circulation that the Lightning-Rod Company will always find it in advance of their agents. Yours respectfully,

J. K. MACOMBER, Prof. of Physics, I. A. C.

Ames, Iowa, November 3, 1879.

We intend that the MANUFACTURER AND BUILDER shall do its share to assist Prof. Macomber in his praiseworthy endeavors to protect those not versed in electrical science from being victimized by ignorant impostors.

MORE RAILROADS IN AFRICA.—The King of Abyssinia contemplates the construction of a railroad from Arkiko, one of the principal ports of the Red Sea, to Adona, the capital of Abyssinia.

Dies and Taps.

The adjoined engraving (Fig. 1) represents one of the many refinements introduced in the business of the practical machinist. It is a box containing a complete set of six dies and taps, with the die stock, and made in four sizes—Nos. 1, 2, 3 and 4. It is forged in one piece from good quality wrought iron, finished and case-hardened. It is strong, well proportioned, and light. The spring bolts, when thrown back by the thumbs, permit the die to drop out of the stock to be replaced by another. The dies consist of chasers inserted in collets. The dies cut very fast and easily, and should be passed once over the bolt without turning back, until the desired length of thread has been cut. They are useful in gauging or sizing screws which have been cut on an engine lathe, as they will finish the threads perfectly and size them exactly. Machinists' hand taper taps will be furnished with die stocks; they are designed to pass once through nuts without backing out, cutting clean, full threads in the operation. The taps and dies will be furnished for cutting the United States standard thread, unless other forms or sizes are ordered. A neat wooden box is furnished with each die stock, containing the stock, dies and taps in convenient receptacles.

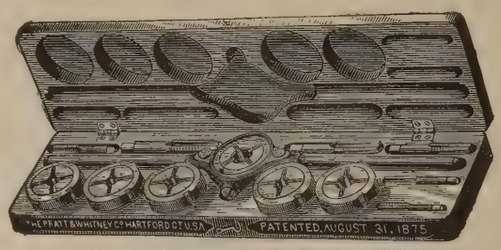


Fig. 1.—Improved Die Stock and Die.

No. 1 die stock is furnished with five dies and taper taps for cutting the following sizes and number of threads: ¼, 20; 5/16, 18; ⅜, 16; 7/16, 14; ½, 13. No. 2 is furnished with six taps and dies; sizes and threads as follows: 5/16, 18; ⅜, 16; 7/16, 14; ½, 13; ⅝, 11; ¾, 10. No. 3 is furnished with five taps and dies; sizes and threads as follows: ½, 13; ⅝, 11; ¾, 10; ⅞, 9; 1 inch, 8. No. 4 is furnished with six taps and dies; sizes and threads as follows: ⅞, 9; 1 inch, 8; 1⅛, 7; 1¼, 7; 1⅜, 6; 1½, 6. The prices of these complete sets vary from $19 to $60, according to size, while a smaller size, intended for fine, small work, such as models, clocks, telegraph machinery, etc., containing the set of tools in a velvet-lined case, is made for $8.

The manufacturers of these dies and taps are the Pratt & Whitney Co., of Hartford, Conn.

Toothpick Patent Run Out.

It is reported that the great toothpick monopoly is at an end. Toothpicks may seem rather a small thing to get up a monopoly on, yet such was the case. The familiar toothpick which we take up as we leave a restaurant, is made of whitewood and pointed at both ends. This little article was patented in 1866, but the patent has just run out, and competition is now making things lively. The only and original factory, in Bucksfield, Me., used from 3,000 to 5,000 cords of wood every year. For 25 cents 2,500 toothpicks were sold, and a large profit obtained. The complicated machinery took in a log 6 feet long and 18 inches in diameter, and chewed it up into toothpicks. But the old and original factory seems to be about ruined by Western cheap labor. Another factory has started up in the woods of Western Ohio, and with similar machinery is showing that every log has "millions in it" in the shape of toothpicks. The price per 2,500 fell from 25 cents to 20 cents, then to 18, 16, 14, and finally to 10 cents retail and 8 cents wholesale, and here it stands. Whether competition will prove the life or death of the toothpick remains to be seen.

A NEW METHOD OF MAKING STEAM BOILERS.—An English engineer named Whitehead, recently exhibited at Owlestan, near Sheffield, a boiler made on a new plan. In making this boiler a ring of steel is cast and heated; then it is placed upon a large roller, and by the aid of smaller rollers it is enlarged to the requisite dimensions. The ring is run from one end of the roller to the other, and is returned by reversing the machinery. The heads necessary for the completion of the boiler are subsequently put on with bolts. The machinery is rather expensive, and it is its cost which is said to be the point upon which the success of the invention hinges. The inventor claims that within six hours he can construct the shell of a boiler of a more durable nature than those now made with iron or steel plates riveted together. There is no doubt that such a boiler must be stronger, as the danger of tearing the seams on the cylindrical surface, where the strain is the strongest, is done away with by the total absence of such seams.

Ratchet Drills.

The improvements in drills, especially the twist drill, have made it possible to apply more pressure to the drill, make it cut deeper, and therefore bore faster; but at the same time have made it necessary to apply a more powerful leverage to the hand than the common swivel.

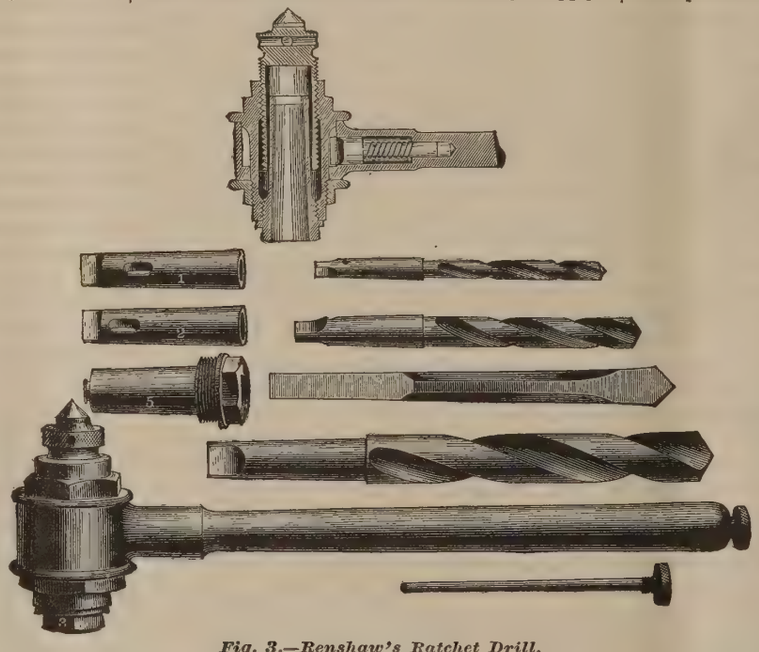


Fig. 3.—Renshaw's Ratchet Drill.

Fig. 2 represents such a ratchet drill as improved by Mr. Renshaw and manufactured by the Pratt & Whitney Company, of Hartford, Conn. A view of the drill is represented below, while at the top of the engraving a section is given of the spindle, showing its interior details. The handle, 15 inches long, is drop-forged, of tough wrought iron. The spindle, of steel, has substantial ratchet teeth cut in its periphery, engaging with a pawl lodged in the handle, which covers both pawl and ratchet, and protects them from dirt. The feed-screw is of steel, 3 inches long, 17/16 inches diameter, and hollow; being hardened, it is not liable to injury in ordinary use. It gives the drill large capacity in small compass, the length from top of feed-screw to bottom of drill-collet being only 5 inches. By transferring the collet and feed-screw, as arranged for right-hand drilling, to opposite ends of the spindle, the ratchet may be used for left-hand drilling, a feature that practical men will appreciate. Four sockets are furnished with each drill. Nos. 1, 2 and 3 correspond in size of holes with sockets of same numbers made by the Morse Twist Drill and Machine Co., for drills from ¼ to 1¼ inches diameter, with shanks of the Morse standard taper. Socket No. 5 is for square shank drills of any size between ¼ to 1¼ inches diameter, which are the extreme sizes that this ratchet is adapted to carry. Nos. 3 and 5 sockets are held in the spindle by screw-thread. Nos. 1 and 2 sockets have taper shanks, fitting No. 3 socket, and can be forced out of position by turning in the feed-screw until it bears upon their end. The feed-rod, when not in use, is placed in the handle and held by screw-thread. The sockets can be utilized in any drilling spindle that may be fitted to receive them. The price of this drill, with four collets, is $20.

Sanitary Science as Applied to Workshops.

The greatest discomfort in our workshops in summer is caused by exposure to an excess of sunlight and a deficiency of ventilation. The first may be corrected by awnings, shades, curtains, or, what is best of all, by foliage, when the circumstances for its growth are favorable; and all this may be accomplished at so trifling an expense as to be nothing compared with the resulting benefit to the workmen. The second may be corrected by the use of fans or blowers, which, notwithstanding they are more expensive by reason of first outlay and continuous cost of running, pay their expenses many times over and over again when we consider the advantages derived from an increase in the products of labor, as well in quantity as in quality. A workman cannot possibly do his best in a hot and stagnant atmosphere, and it is useless to expect it. A blower like Sturtevant's, or any other good blower, changes all this. Fresh air blown into a workshop is a great advantage, and in many instances this can be done at no great expense. Workshops are often made very uncomfortable on account of low ceilings, or low roofs upon which the sun beats down, converting the room beneath into a furnace. Sometimes this can be remedied by roof tanks, sometimes by a false roof on top, or, in other cases, by a space between the roof and the ceiling of the room below. In mills where there are furnaces, water screens are a great advantage, and we are pleased to state that their use is spreading, as well as many other little contrivances, which, trifling as they seem, may add greatly to the improvement of the material as well as the mental condition of the workmen.

Employers begin to realize more and more that it does not pay to treat their employees as mere machines, and that besides wages, there ought to be another incentive to encourage the workmen if the maximum value of the products of labor is desired. We therefore again call the attention of owners, managers and foremen of workshops to this important subject.

GYPSUM IN CEMENT.—During the past decade, the use of gypsum for the improvement of ill-burnt Portland cement has attracted some attention. Herr F. Schott gives the following results of experiments:

	Tenacity, after 7 days.		
	Weight.	Air.	Water.
Pure cement	100	10.5	8
" " with 1 p. c. unburnt gypsum.	115	14.0	—
" " with 3 p. c. "	120	18.0	10
" " with 1 p. c. dead burnt "	112	11.0	—
" " with 3 p. c. " " "	113	12.5	—
" " with 3 parts sand	—	8.0	6
" " with 3 parts sand, and 3 per cent of unburnt gypsum	—	13.0	7

Latest Market Report of Building Materials.

NEW YORK PRICES.

ARTICLES MARKED WITH A STAR (*) ARE QUOTED IN GOLD.

—o—

LUMBER.

Pine, very choice and extra dry, per M	$55 00 a 60 00
Pine, good	45 00 a 50 00
Pine, shipping box	18 00 a 22 00
Pine, common box	15 00 a 17 00
Pine, common box, ⅝	13 00 a 15 00
Pine, tally plank, 1¼, 10 inch, dressed, each	35 a 40
Pine, tally plank, 1¼, 2d quality	35 a 38
Pine, tally plank, 1¼, culls	25 a 28
Pine, tally boards, dressed, good	28 a 30
Pine, tally boards, dressed, common	22 a 25
Pine, tally boards, culls, dressed	21 a 23
Pine, strip boards, merchantable	16 a 18
Pine, strip boards, clear	22 a 25
Pine, strip plank, dressed, clear	33 a 35
Spruce boards, dressed	18 a 20
Spruce plank, 1¼-inch, dressed	22 a 25
Spruce plank, 2-inch	28 a 34
Spruce wall strips	13 a — 15
Spruce timber, per M	16 00 a 19 00
Hemlock boards, each	14 a — 16
Hemlock joist, 2½x4	15 a — 16
Hemlock joist, 3x4	16 a — 18
Hemlock joist, 4x6	40 a — 44
Ash, good, per M	38 00 a 45 00
Oak	38 00 a 45 00
Maple culls	20 00 a 25 00
Maple good	42 00 a 45 00
Chestnut	35 00 a 48 00
Cypress, 1, 1½, 2, and 2½-inch	35 00 a 40 00
Black walnut, good to choice	85 00 a100 00
Black walnut, ⅝-inch	75 00 a 85 00
Black walnut, selected and [illegible]ed	110 00 a150 00
Black walnut counters, per f	12½ a 25
Cherry, wide, per M	85 00 a100 00
Cherry, ordinary	50 00 a 80 00
White wood, chair plank	60 00 a 70 00
White wood, inch	40 00 a 50 00
White wood, ⅝-inch	30 00 a 35 00
White wood, ⅝ panels	35 00 a 40 00
Shingles, extra sawed pine, 18-inch	4 00 a 5 00
Shingles, clear sawed pine, 16-inch	3 75 a 4 00
Shingles, cypress, 24x6	18 00 a 21 00
Shingles, cypress, 20x6	10 00 a 12 00
Lath, Cargo rate	1 40 a 1 45
Yellow dressed pine flooring	25 00 a 30 00
Yellow pine girders	30 00 a 40 00
Locust posts, 8 feet, per inch	18 a 20
Locust posts, 10 feet	24 a 25
Locust posts, 12 feet	29 a 34
Chestnut posts, per ft	3 a 3½
Basswood per M	25 00 a 30 00

Cargo rates, 10 per cent off.

BRICKS.

	Cargo.	Afloat.
Pale, per M.	4 25 a	4 50
Up Rivers	6 00 a	6 50
Haverstraw Bay	6 50 a	6 62½
" " choice	6 75 a	7 00
Favorite Brands	7 25 a	7 50
Hollow Fire-Clay Brick	9 00 a	9 25

FRONTS.

Croton—Brown, per M.	7 50 a 8 50
" Dark	8 50 a 9 50
" Red	9 00 a 9 50
Philadelphia	26 00 a 28 00
Trenton	24 00 a 29 00
Baltimore	34 00 a 38 00
Clark's Ottawa White	25 00 a — —

Yard prices 50 cents per M higher, or with delivery added $2 per M for hard and $3 per M for front brick. For delivery add $5 on Philadelphia and Trenton, and $6 on Baltimore brick.

IRON—PER TON.

Duty.—Bar, 1 to 1½c. per lb.; Railroad, 70c. per 100 lbs.; Boiler and Plate, 1½c. per lb.; Sheet, Band, Hoop and Scroll, 1¼ to 1¾c. per lb.; Pig, $7 per ton; Polished Sheet, 3c. per lb.; Galvanized, 2½c. per lb.; Scrap Cast, $6 per ton; Scrap Wrought, $8 per ton—all less 10 per cent. No Bar Iron to pay a less duty than 35 per cent ad val.

Pig, Scotch—Coltness	27 00 a 27 50
" Glengarnock	24 00 a 24 50
" Eglinton	23 50 a 24 00
" American, No. 1	27 00 a 30 00
" American, No. 2	26 00 a 28 00
" American, forge	25 00 a 26 00

	Store prices.	Cash.
Bar, Swedes, ordinary sizes	— 5½ a —	5¾
Bar, Swedes, nail-rod	— 6 a —	6¼

LEAD—PER 100 POUNDS.

*German	— — a — —
*English, common	— — a — —
*Spanish	— — a — —
*Foreign, refined	— — a — —
*Bar, and Pipe	6 50 a 7 50
*Sheet	8 00 a — —
*Domestic	5 50 a 5 63½

NAILS—PER KEG.

10d to 60d, common, fence and sheathing	3 70 a — —
8d and 9d, common	3 95 a — —
6d and 7d, common	4 20 a — —
4d and 5d, common	4 45 a — —
3d and 4d, light	5 20 a — —
3d, fine	5 95 a — —
2d, fine	5 95 a — —
Cut spikes, all sizes	4 95 a — —
Clinch nails, 1½ to 1¾ inch	5 95 a 6 20
do. 2 to 2¼ inch	5 70 a — —
do. 2½ to 2¾ inch	5 45 a — —
do. 3 inch and longer	5 20 a — —

TIN PLATES.—Duty, 1 1-10 cents per pound.

*I. C. charcoal, 10x14, per box	8 00 a 8 50
*I. C. coke, 10x14	7 25 a 7 75
*I. X. charcoal, 10x14	10 25 a 10 50
*I. C. charcoal, 14x20	8 00 a 8 50
*I. X. charcoal, 14x20	10 25 a 10 50
*I. C. coke, 14x20	7 25 a 7 75
*I. C coke, terne, 14x20	7 00 a 7 12½
*I. C. charcoal, terne, 14x20	7 25 a 7 50

ZINC.—Duty, sheet, per lb., 2½ cents.

Sheet, (cask) per lb	— 8¾ a — 8½
Sheet, (open)	— 9 a — 9½

SOLDERS.

No. 1	— 14 a — 15
No. 2	— 13 a — 13½

STONE.—Cargo Rates.

Amherst Freestone, in rough, per cubic foot	— — a — 85
Berlin Freestone, in rough	— — a — 95
Berea Freestone, in rough	— — a — 75
Brown-Stone, Portland, Conn	1 25 a 1 50
Brown Stone, Belleville, N. J	1 00 a 1 50
Granite, rough	— 60 a 1 25
Canaan Marble	1 25 a 1 50
Dorchester, N.B., Stone, rough, per foot	— — a 1 00

PAINTS.

*Carmine, American, per lb. gold	6 00 a 6 25
Chalk, per lb.	— 00⅜ a — 00½
China Clay, per ton gold	20 00 a 22 00
Chrome yellow, dry, per pound	— 12½ a — 28
Lead, red American, per pound	— 8 a — 9
Lead, white American, pure, in oil	— 8 a — 9
Lead, white American, pure, dry	— 7¾ a — 8½
Lead, white English, pure, in oil gold	— 9½ a — 10½
Litharge	— 7 a — 8
*Ochre, Fr., dry, per 100 lbs	1 50 a — —
Ochre, ground, in oil, per lb	— 6 a — 15
Ochre, Vermont, per 100 lbs	— 75 a 1 00
*Orange Mineral, English gold	— 9½ a — 10
Paris White, American	— 1½ a — 1¾
Paris White, English, prime	— 2 a — 2¼
Paris Green	— 15 a — 28
Plumbago paint, patent, per lb	— — a — 25
Putty, per lb	— 1¾ a — 2½
Spanish Brown, dry, per lb	— 1⅛ a — 1¾
Spanish Brown, ground in oil, per lb	— 8 a — 9
Venetian red, per cwt	1 75 a 2 00
*Vermilion, Chinese, per lb	— 90 a 1 00
*Vermilion, Trieste	— 80 a — 90
*Vermilion, quicksilver, bags gold	— 65 a — 67
Vermilion, American, common	— 15 a — 18
Whiting, per 100 lbs	— 50 a — 80
Zinc, white American, dry, No. 1	— 5 a — 7½
Zinc, white American, No. 1, in oil	— 8 a — 10
*Zinc, white French, dry, (Red Seal,) gold	— 8 a — 8¼
Zinc, white French, in oil gold	— 10 a — 10½

VARNISHES—PER GALLON.

American Wearing Body	3 50 a 4 00
Coach Body	2 35 a 3 50
do do	1 80 a 2 00
Furniture	1 25 a 2 50
Black Asphaltum	1 00 a 1 50
Brown Japan	1 00 a 1 20
Liquid Paint Dryer	1 35 a 1 75
Harness, (black)	3 00 a 4 50
Shellac, Spirits	3 00 a 3 50

CEMENT—PER BARREL.

Portland (imported)	2 75 a 3 50
Portland (American)	2 50 a 2 75
Portland (Spanish)	2 50 a 2 75
Portland (Lafarge)	3 20 a 3 40
Portland (German, Bonner)	2 75 a 3 25
Lime of Tiel	2 20 a 2 30
Lime of Tiel, per ton	15 00 a 18 00
Roman	2 75 a 3 25
Keene's, coarse	6 50 a — —
" fine	10 50 a — —
Martin's, coarse	6 00 a — —
" fine	10 50 a — —
Rosendale	— 85 a 1 00

DEADENING AND ROOFING MATERIAL.

Mineral Wool for Roofs and Deadening, per lb. — 1¼ a — 1½

HAIR.

Cattle, per bushel of 7 lbs	— 9 a — 12½
Goat, " "	— 15 a — —

SLATE.

Purple roofing slate, per square	$6 00 a 6 50
Green slate	7 00 a 7 50
Red slate	10 50 a 11 00
Black slate, Pennsylvania, (at Jersey City)	5 00 a 5 25
" " Cargo rate	3 50 a 4 50
Slate tiles, 1¼-inch, rubbed, per square foot	20 a — 25

PLASTER PARIS.

Duty.—20 per cent ad. val. on calcined; lump free.

Nova Scotia, white, per ton	3 50 a 3 50
Nova Scotia, blue	3 00 a 3 25
Calcined, Eastern and city, per bbl	1 00 a 1 15
Calcined, city casting	1 20 a 1 25
Calcined, city superfine	1 30 a 1 50

LIME—PER BARREL.

State, common	— 70 a — 75
" finishing	— 85 a — —
Rockland, common, cargo rate	— 60 a — 65
" finishing	— 80 a — 85
Ground	— 70 a — —

Add 25 cents to above figures for yard rates.

FOREIGN WOODS.

MAHOGANY.

St. Domingo, crotches, ordinary to good, per ft	— 20 a — 35
St. Domingo, crotches, fine	— 25 a — 50
St. Domingo, logs, small	— 5 a — 8
St. Domingo, logs, large	— 20 a — 30
Frontera, Mexican, large	— 11½ a — 16
Frontera, Mexican, small	— 8 a — 10
Other Mexican	— 8 a — 14
Honduras	— 10 a — 15

ROSEWOOD.

Rio Janeiro, ordinary to good, per lb	— 2½ a — 6
Rio Janeiro, good to fine	— 5 a — 8
Bahia, ordinary to good	— 2 a — 6½
Bahia, good to fine	— 4½ a — 8
Honduras, per ton	10 00 a 20 00
Satin Wood, per foot	— 15 a — 60
Tulipwood, per lb	— 6 a — 12½
Lignumvitæ, small, per ton	10 00 a 20 00
Lignumvitæ, large	25 00 a 50 00

CEDAR.

Cuba, per superficial foot	— 10 a — 12½
Mexican, small	— 8 a — 10
Mexican, large	— 10 a — 14
Florida	— 30 a 1 50

DRAIN AND SEWER PIPE.

(Delivered on board at New York.)

Discount 50 to 60 per cent, according to quality and size of order.

PIPE, per running foot.

2 inches diameter,	$0 13	10 inches diameter,	$0 70
3 "	0 16	12 "	0 80
4 "	0 20	15 "	1 25
5 "	0 25	18 "	1 60
6 "	0 30	20 "	2 00
7 "	0 35	22 "	2 50
8 "	0 45	24 "	3 00
9 "	0 55		

DOORS, WINDOWS, AND BLINDS.

DOORS, RAISED PANELS, TWO SIDES.

2.0 x 6.0	1¼ inch.	$ 67	—
2.6 x 6.6	1¼	— 95	—
2.6 x 6.8	1¼	— 99	—
2.8 x 6.8	1¼	1 04	—

DOORS, MOLDED.

Size.	1¼ inches.	1½ inches.	1¾ inches.
2.0 x 6.0	$1 23	—	—
2.6 x 6.6	1 52	1 93	—
2.6 x 6.8	1 57	1 85	—
2.6 x 6.10	1 59	2 01	—
2.6 x 7.0	1 62	2 09	—
2.8 x 6.8	1 62	2 09	2 57
2.8 x 7.0	1 69	3 17	2 69
2.10 x 6.10	1 79	2 26	2 84
3.0 x 7.0	1 87	2 45	3 00

INSIDE BLINDS.

Per lineal foot, 4 folds, pine	04 a — —
Per lineal foot, 4 folds, ash or chestnut	— 07 a — —
Per lineal foot, 4 folds, cherry or butternut	— 08 a — —
Per lineal foot, 4 folds, black walnut	— 10 a — —

OUTSIDE BLINDS.

Up to 2.10 wide, per lineal foot	— a —
Up to 3.1 wide	— a —
Up to 3.4 wide	— a —
Do. painted and trimmed	— a —

GENERAL REVIEW OF THE MARKETS.—The tendency of the markets during the past month has been toward steady improvement, and values on all the leading articles under review have been well sustained. In anticipation of the early closing of navigation, buyers are beginning to look around for supplies, and although unusually backward this year, accumulations are now being freely made, and the volume of business during the present month promises to be of large proportions.

THE MARKETS IN DETAIL.—In the lumber market the past month business has continued good. Buyers generally appear to have realized the comparatively small accumulation of stock on hand, and the next to impossibility of arranging for any important additions for winter uses, and in a great many cases anxiety has been displayed in decided contrast to the apathy before current. At all primary sources yet within reach, there has been a firm feeling at extreme rates, while the cost of transportation has been steadily increasing.

In the brick market the advantage of the situation has been principally in favor of the selling interest, and the market throughout on hards has been strong. Dealers have not been making many important additions to their accumulations for winter stock, and have been quite backward in this respect, many considering the firmness of the market as only temporary in character, and being inclined to hold off in hopes of better terms. They agree that the amount held at primary points is not only full, but very large, and that eventually manufacturers will be compelled to realize with greater freedom.

In the lime market trade has moved slowly, and while supplies in first hands have not accumulated, there has been quite enough stock to go around, with something to spare. In view of the low rates ruling, and which at the present cost of freight, show an actual loss to the producer, it is a matter of some surprise that dealers are not more ready to call for supplies, and it may be that before spring this may be regretted.

In the lath market the trade continue to report their expressions of confidence in a continuance of the present satisfactory condition of business, and most all have made up their minds that no serious reaction on values can occur during the balance of the season.

In the hardware market operations have been neither very heavy nor general, business gradually going into the dull winter condition.

In the metal markets Scotch pig has only met with a light demand for consumption, the undertone ruling rather tame. American pig has been slow of sale and somewhat uncertain in value, but with the general tendency in sellers' favor. Domestic pig lead has found a somewhat better demand, and the market has gained tone with cost increased. Pig tin has found little demand, and the market has shown an irregular tone. Zinc plates have had a moderately active but uncertain demand, with prices a trifle weak.

The paint markets have been pretty active in a wholesale way, and there has geen a generally cheerful tone extant.

The Metal Trade in England.

A correspondent of the *American Manufacturer*, published at Pittsburgh, Pa., writes that journal that the English workmen in the iron trade, despairing of any future improvement, are anxious to get out of the country. Miners especially are leaving in considerable numbers. It was the boast the other day in Scotland of a union agent that during the last four or five years, as many as 160,000 miners had left the country; some of them had gone to the United States, not so much with the expectation of continuing to work as miners, as in the hope of pushing their way into the agricultural districts of the West.

At Bradford the operative engineers, like many men of the same order in London, have for many weeks been out on a strike against a slight reduction in wages, and there is no prospect of their getting into work again, as their places have been supplied by new hands. Some 300 of them, however, have been engaged for the United States, and the statement is that an agent from Philadelphia is to go over to see to their embarkation. The correspondent then makes the following statements:

"A friend of mine, who assumed that he could make money by manufacturing cutlery in Sheffield instead of the United States—though he hoped to retain the United States for his market—will soon have succeeded in getting 100 of his hands landed upon United States' soil; there they will begin the manufacture of razors mainly. The statement circulated here is that the razor trade has not hitherto succeeded in America on account of the want of good grindstones, so that the emigrants have taken out grinding stones! but I need not tell you that the best grindstones we can get in England come from America.

"The two great American weighing machine and scale firms have proved themselves troublesome competitors with our best firms in the same line. This has put Birmingham in particular upon its mettle; one firm there is now producing a platform machine, which in appearance, precision, and reliability is claimed to be a considerable advance upon the best American weighing machine. Moreover, it is offered at a price less than that at which the American machine is sold. I have not yet seen the new Birmingham machine, but I understand that instead of the pillars and scales being of wood, they are of wrought iron. The French counter balance, with indicator and marble top stand, is in like manner being produced by the same makers, for less money.

"The recent shipments for one week have been 3,936 tons, as compared with 5,610 tons in the corresponding week of last year.

"The manufacture of steel is growing with its enlarged uses. Bolckow, Vaughan & Co. are keeping their steel works running full time, and are making arrangments to lay down two new and more capacious Bessemer converters to replace the small ones they now have. When this work is completed the manufacture of steel plates and angles will be carried on there and steel castings will also be produced. Works, to be called the Roseberry Steel Works, are now nearing completion, and their capacity will be 40 tons of steel per day. The Siemens-Martin furnace will be here employed. It is asserted that scrap will be used principally, instead of pig iron, and castings of every description for collieries, ironstone mines, blast furnaces, etc., will be the leading products.

"Business at Sheffield has slightly improved during the week, the armor plate mills are well on and manufacturers are looking for heavier contracts in this branch. The file trade continues to manifest some degree of activity, and one firm in particular is running full time on a large Russian order. At the Park View Steel Works, Owlenton, an experiment has been made with a new process for constructing steel or iron boilers weldless and seamless. The invention has been patented and the experiment is said to be in every way satisfactory.

"Owing to the excessive competition in steel rails, Sheffield firms, notwithstanding their adoption of improved modes of manufacture, find that it is almost impossible for them to compete for foreign orders with houses near the coast, who have a cheaper mode of transit than firms in the Midlands. Some of the local firms that first introduced the making of steel rails to Sheffield, and who for some time enjoyed an enormous business in connection with this manufacture, have not had an order on their books for nearly twelve months, being unable to accept them at the price offered.

"The third and final dividend to the creditors of the Albion Steel and Wire Co., of Sheffield, is announced. The dividend is the magnificent sum of 3⅜d in the pound, which with the previous dividend, makes 3s. 2¼d. in the pound. The company was floated just at the hight of the prosperous times (in 1872) with a capital of £150,000, and lost in the three years following £73,691.

"Business at Birmingham is still very slack in nearly all departments, and as a necessary consequence of this circumstance prices are still falling. Even the cabinet brass foundries who have enjoyed a large run of prosperity and good prices, have now found it necessary to increase their discount 2½ per cent., following in this respect the lead of the smaller non associated masters. Brass and copper wire, tube, and sheets, have also been reduced; cut nails, washers, iron wire, and various other commodities, are offered at lower rates by individual firms, and the steel and iron wire trade continue very dull. There is still a large quanitity of Westphalian wire coming in at from 18s. to 20s. under the selling price of English wire for pin, bottling, screw and other manufacturing purposes.

A large local wire firm in Birmingham is receiving bright iron wire from Germany *via* London, by the Great Western railway, at a cost of 16s. 8d. per ton, and free delivery in Birminghan to London, is 22s. 6d. per ton, or something like 35 per cent. more than the import charge for more than treble the distance.

"What is to be the ending it is difficult to state; so far as appearances go, the iron trade is gone, and the dearth of business in steel is such that no one will be tempted to make any arrangements for starting the old works that now lie stagnant in all parts of the country. 'The good times,' says a Welsh correspondent, 'inaugurated in the iron and steel trade of America, have had, as was expected, some effect here, and American orders for large quantities are flowing in this way.' He further goes on to say: 'Inquiries from Canada are numerous, and orders have been placed lately for rails. Dowlais has been busy with rails for Santos and Montreal, Rhymney with rails for Aarlmus, and several vessels are loading at Newport for America.'

"The tin-plate trade shows a drooping tendency, from over-production, and meetings of the masters are being held with a view to reduce the make still further than has already been done."

We add to this correspondence the following statement, which we clip from a contemporary: "The English railroads show a decrease in their earnings for 1879, as compared with the preceding year, of $3,310,500, equal to 3.15 per cent. The United States roads show an increase of $972,560, or 3.2 per cent; while the earnings of the Chicago and Northwestern railroad alone for the months of June and July, 1879, were increased $465,000 over the corresponding period of last year. Lastly, it is reported that the Pittsburgh, Cincinnati and St. Louis road has been doing such an immense freight business that there have been several blockades on the track, and an order was issued refusing to take any more freight until further notice."

A CHEAP COMPOSITION FOR STEAM COVERING.—A French firm is using a composition for covering boilers, steam pipes, and similar articles, which is certainly cheap and said to be very effectual. The surfaces are covered with sawdust mixed with flour paste, If the paste is not very liquid, the mixture being used in the form of moderately stiff dough, and the surfaces of the boilers or pipes have been well cleaned from grease, the adhesion is perfect and the material is free from cracks. Five layers of this composition are recommended, each about one-fifth of an inch thick. It is said that one inch of this composition will give better results than double that amount of the materials usually employed. The paste is composed of rough flour without the addition of starch. The mixture can be applied without a trowel, and, if there is much exposure, two or three coatings of tar will render the composition impervious to water. Copper tubes should first be treated to a hot liquid solution of clay, so as to increase the adhesion of the sawdust.

Cause and Cure of Sea-Sickness.

In addition to what we have already said in regard to sea-sickness, we will now give the opinion of Mr. Henry Naylor, of Edinburgh, who holds that it is caused by a cerebral anæmia, which means a deficiency of blood circulation in the brain. He says:

"The rapid swinging of the vessel, and the body with it, irritates the eyes and vision, and this by reflex action produces a spasm of the cerebral capillaries; this explains the feeling of faintness and giddiness that comes on suddenly, just as the vessel gives a big swing. The sudden emptying of the cerebral vessels causes the stomach to sympathize, resulting in efforts of vomiting, whether the stomach be full or empty. These symptoms are most distressing when the subject is in a standing or sitting position, with the eyes open. If he lies down the change of position relieves the anæmia, the faintness and giddiness pass off, and the sickness ceases. But occasionally even a recumbent position does not give relief if the eyes are kept open. When they are shut the symptoms are not felt in the least. I have known this to be the case with several ladies who were never comfortable while at sea unless they were lying down with their eyes closed. They were able to eat meals and retain them if they laid down and closed their eyes immediately afterwards—in fact, I have been obliged to keep some constantly in bed to prevent their dying of starvation. A fact that helps to show the feasibility of the anæmic theory, is that brandy and other stimulants give considerable relief for a time, which would not be the case if cerebral congestion had to do with sea-sickness. The explanation of how sea-sickness continues so persistently in some, is that the sickness weakens the heart's action, and this keeps up the cerebral anæmia, and that in turn again produces the sickness; so that prolonged sea-sickness is due to a circuit of causes, the one producing the other—the visional irritation, cerebral anæmia, sickness, weak heart's action."

Amyl nitrate usually does good in sea-sickness, if used at once, because, being an anti-spasmodic, it relieves the spasm of the cerebral vessels, and thus the brain is refilled with blood; but if it fails, then the persistent sickness, by its effect on the contractions of the heart, prevents the brain from getting a sufficient supply of blood, and thus the brain becomes anæmic, not from a spasm of the capillaries, but from an insufficient power of the heart. In this case alcoholic stimulants in small doses, frequently repeated, are better.

ELECTROTYPING APPLIED IN MAKING STATUES.—The practical problem of reproducing a large clay model in bronze by the electrotyping process instead of casting, has at last been successfully accomplished in Belgium. The papers report that the Electro-Metallurgical Company, of Brussels, has completed a colossal statue in bronze of Jan Van Eyck, (the great ancient painter who invented the art of painting in oil colors), by the system of electro-deposition. The galvanic process occupied several months, although a thickness of but 6 to 8 millimeters (about ¼ of an inch) was attained. It is the largest article which has been produced by this method, being over 12 feet in hight, and is necessarily a much more perfect imitation of the model than could be obtained by casting.

Home Department.

Combined Seal and Overflow Basin.

The two most important desiderata of a wash-basin, are a good seal and reliable overflow; but we are sorry to say that in most basins as at present constructed, these are unreliable and insufficient. The seal is either absent or works imperfectly, while the overflow is inadequate and also easily stopped up. A new arrangement by which the two so very desirable features mentioned, can be secured, must be welcomed by every housekeeper, especially those who have smelled sewer gas in their bed-rooms or experienced a small inundation from a defective overflow; and we ask, Who has not?

The basin of which the peculiar arrangement is shown in the adjoined engraving has now withstood the test of experience for more than four years, and is competent to stand the most critical examination, because:

1st. It consists of an earthen bowl, suspended within an enamelled iron shell, called the "safety shell." The top of this safety shell contains a groove, in which a water-proof packing is inserted, which by the peculiar clamp arrangement is pressed water-tight against the lower side of the marble slab; this prevents mold, and foul and unhealthy odors, which are so often met with between the connections of the ordinary basins. But the most important feature is:

2d. Its seal consisting of a trap, out of which the water cannot possibly be siphoned, and which therefore is a positive security against the admission of sewer gas from the waste pipes. The form of this seal is a modified bell-trap, universally acknowledged by scientific men as the most effective trap ever invented.

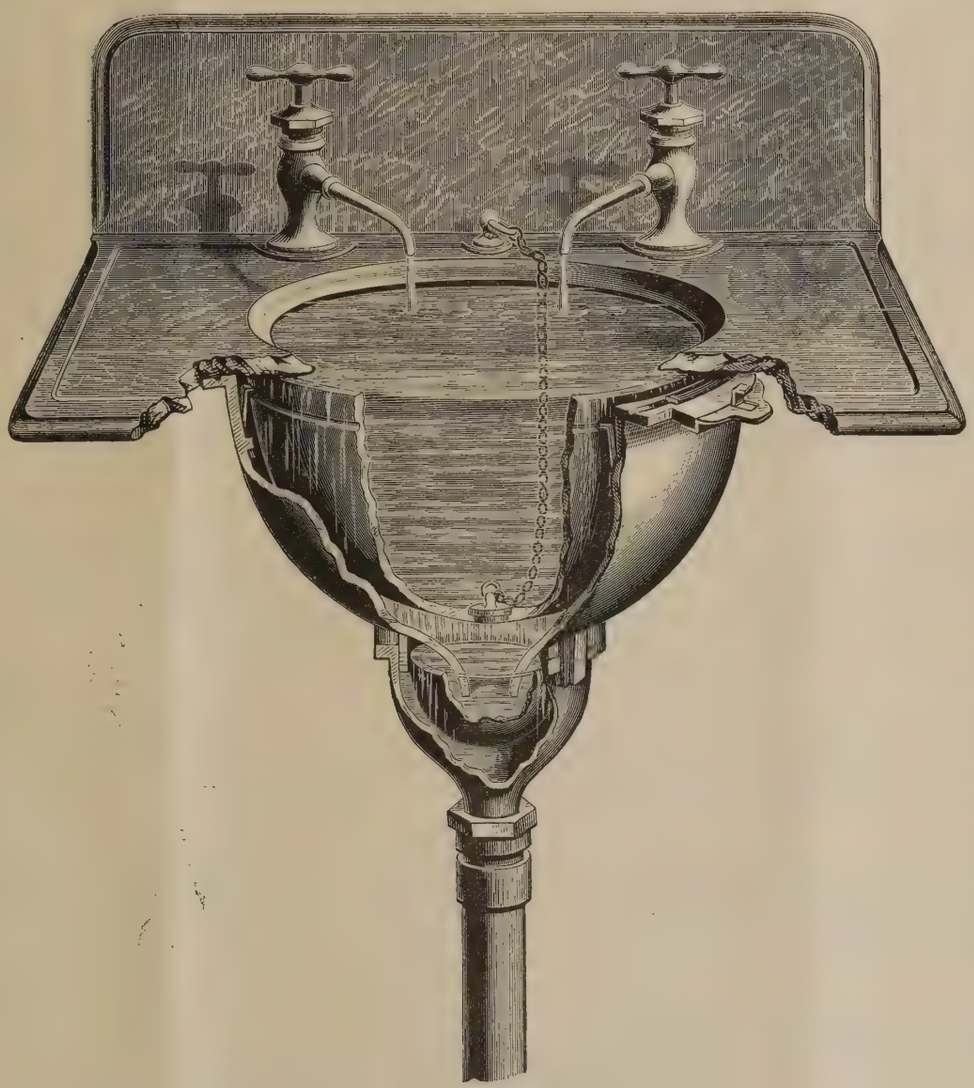
3d. Its overflow is not a small hole, easily stopped up, but it overflows all around the porcelain basin, which is surrounded by an enamelled iron basin, from which the water flows into the cup-shaped trap. In this way there is no possibility of the flow being impeded.

4th. It is easily removed and replaced under the marble slab—in fact, it only takes about one minute to take a broken basin out and replace it by a new one, while at the same time the connection with the discharge pipe is more simple and secure. It has only one connection, while the old style bowl has three.

5th. For this reason it is cheap—in fact, much cheaper than any other bowl ever offered to the public. This is because the bowl itself includes the super-excellent trap, union coupling, silver-plated plug for bowl, water-proof packing for shell and trap, and clamps—in fact, everything below the marble slab, while the new improved and simple method of attaching it securely to the slab is another item of economy not to be lost sight of.

6th. It furnishes the luxury—very desirable in hot weather—of being able to wash in a brimful bowl of running water, without danger of damage by an overflow.

7th. If the bowl should get cracked by accident, there is even no damage done by water, as the enamelled iron shell around it receives the leakage and carries it off at once, while a new bowl can be inserted by any handy person without the aid of a plumber or mechanic—a peculiarity possessed by no other wash-bowl ever made. The way in which this is accomplished is, that outside, near the top of the safety shell, three wedge-shaped ears are cast at equal distances apart, while corresponding wedge-shaped clamps are leaded into the under side of the marble slab, intended to receive the ears of the shell, so that by a turn to the right or left the basin is fixed or released, as desired.



COMBINED SEAL AND OVERFLOW BASIN.

It is not surprising then that this basin, which has been named the Wellington Overflow, has obtained several premiums and medals at various exhibitions, including that of the Maryland Institute at Baltimore; the Massachusetts Charitable Mechanics Association, Boston; and the New Jersey State Fair, at Waverley, as possessing unsurpassed features in regard to sanitary precautions and damage by overflow, leakage or dampness.

It is now being introduced in most of the first-class houses, of which, since the completion of the elevated railroads, so many are now being erected in the upper part of this city, and we recommend house owners, architects and plumbers, who may perhaps not yet have seen these excellent basins at any of the many places where they are already in use, to inspect them carefully at the depot of the general agents for the United States, Messrs. C. E. Robinson & Co., 61 Beekman street, New York.

Finishing Wood-Work.

Some of the most important devices for finishing wood-work in a perfect and desirable manner, are those now being introduced in the trade by the Bridgeport Wood-Finishing Company, who have an office at 40 Bleecker street, New York, Dr. D. E. Breinig, agent. These devices consist chiefly of four different materials, which are: 1. *Wheeler's Patent Wood-Filler.* 2. *The Lithogen Primer.* 3. *Lithogen White Lead.* 4. *Silicated Paints.*

The *Wood-Filler* is, as its name suggests, a material intended to fill up the pores of any kind of wood that needs it, so as to prepare it to receive the varnish. All who are experienced in this business, agree that in order to finish wood-work well the perfect filling of the pores is of the utmost importance, and that a material which will do this most perfectly is very valuable, especially if it does this so well that afterward a single coat of varnish will finish the work. This is what Wheeler's wood-filler does, and for this reason it has been adopted in all shops where it has been tried, its superiority being at once apparent. Besides the valuable property of filling the pores, it is not absorbent and not affected by water or damp atmosphere, and cannot be wiped out of the pores, like many other fillers thus far used, which consist of round particles, while these are sharp and angular, which makes them adhere. Then they are perfectly transparent when covered by the shellac or varnish, and show all kinds of woods to the greatest advantage. It is put up in tin cans, ready for use, of 2 to 40 pounds, and in wooden kegs from 25 to 500 pounds. It is in the form of a thick paste, and can be thinned out with spirits of turpentine, or with linseed oil if the wood-work is only to be oiled. It is furnished in different shades, light or dark, in order to suit the various colors of wood.

The *Lithogen Primer* is an excellent material for painters as a first coat in painting, as a knot size, a wood preservative, and a wall size. It is well known that painters, in order to economize oil, often cover new wood-work first with a coat of a size made of glue and water, when a single coat of paint will suffice; but it is also well known that this is a very poor kind of painting, as it easily peels off by the least scratching. The lithogen primer is intended to remedy this defect, and to form a coating hard as stone, for which reason it is thus called, as the name means "stone former," while at the same time it makes a coating that causes one coat of paint to suffice afterward, if it only has body enough to cover.

When painters wish to produce good work, it is their practice to apply several coats until the surface has absorbed all the paint it can. We need not say this is very wasteful in material as well as in labor, while at the same time such a thick multiple skin of paint cannot produce as neat a job as when a thin, well-covering

coat is applied. This is acknowledged by all painters who understand their business. By the use of the lithogen they can accomplish this; it fills the pores of wood, making it impervious, and acts as a wood preservative; and while it causes a perfect adhesion of the subsequent coat of oil paint, it prevents the absorption of the oil in the wood and the well-known dull spots which otherwise cannot be removed except by repeated coats of paint. It has the same effect upon brick, stone, and plaster walls, arresting all further absorption; acts as a water-proof size, killing damp and water spots, and not only secures the adhesion of successive coats of paint, but even causes the adhesion of old coats that may have a tendency to peel off, and even whitewash and kalsomine, while damp walls may be perfectly cured by its application.

The *Lithogen White Lead* is a mixture of white lead with linseed oil, carefully prepared by a peculiar process, by which the valuable properties of both are enhanced, while in the mixture the silica is incorporated. The manufacturers wish it to be understood that they by no means use the silica in the form of water-glass, experience having proved that the presence of soda in the water-glass is a deleterious feature of all paints containing this material, as in the course of time this soda forms a kind of soap with the oils of the paints, and washes off; therefore water-glass paints are not durable, while for these paints great durability is claimed, as well as beauty.

Silicate Paints. These are especially to be recommended for in door work, and for this reason are free of white lead. There are two reasons for this; white lead only keeps its pure white color when exposed; in-doors it turns yellow, while at the same time it is poisonous. The silicate paints are not poisonous, will not change color; dry, firm and elastic without cracking, peeling or chipping; they are not only water-proof, but resist salt air, and are therefore as well suited for out-door work as white lead, and even better, on account of the last mentioned qualities; they require no addition of dryers, as they contain in themselves all the drying qualities, and give to wood, iron, stone and plaster a beautiful enamel surface. They are furnished in all colors, shaded from white through the most delicate tints to the most intense reds, browns, blues, etc., and are furnished in pails of ½, 1 and 2 gallons; not liquid, but thick, so that they must be thinned either with turpentine or raw linseed oil; with the latter they give a varnish finish.

We ought to add that these paints are not merely silicate paints by name, like some others in the market, but they are true silicate paints, containing the preserving and unalterable ingredient—silica in its pure condition, as guaranteed by Dr. D. E. Breinig, who supervises the manufacture of all the articles furnished by this company.

For the benefit of painters who may ask how much it takes to finish certain jobs, we will add that every gallon of this kind of paint will cover as much as 25 pounds of white lead.

Miscellaneous and Advertising.

Three thousand workmen are now engaged upon the St. Gothard tunnel. Nearly 10 tons of dynamite are used per month.

Rupture bands made to order. Single, $2.25; double, $3.50. Best material and workmanship. Send for circular. L. F. de Lesdernier & Co., 166 Greenwich street, New York.

The West is reaping its full share of the business revival which the country is at present experiencing, and the most encouraging reports reach us from that section regarding the improvement in trade. The advance in prices is received by consumers with general satisfaction, who take it for granted that a still greater advance will be made in all kinds of machinery.

APARTADO 373, HAVANA, CUBA, Oct. 29, 1879.

H. W. JOHNS MANUFACTURING CO.:

Gentlemen: I am happy to say that your Asbestos Roofing has proved, up to the present time, quite a success, having perfectly stood the high temperature and heavy rains of this climate.

Your obedient servant, MARQUIS DE MONTELO.

As the winter approaches, it behooves every one using steam to see that their boilers and pipes are properly protected. The most economical non-conducting coverings are those made of asbestos. H. W. Johns Manufacturing Co., 87 Maiden Lane, New York, sole Manufacturers.

H. W. Johns' Asbestos Liquid Paints are strictly pure linseed oil paints, and contain no water. They are the best and most economical paints in the world. Send for samples.

Manufacturers can save 25 per cent of customary outlays by the use of H. W. Johns' Asbestos Liquid Paints, which are of a higher grade than any other paints in use.

The improved Asbestos Roof Coating, as applied to H. W. Johns' Asbestos Roofing, or to any other suitable foundation, forms a fibrous water-proof covering, partaking of the nature of a felt and a paint. It can be applied with a brush or a trowel to any desired thickness, and forms the most durable and economical roofing in use for mills, factories, warehouses, railroad buildings, bridges, etc.

The Family House.

BY F. T. CAMP, ARCHITECT.

This illustration is the second in the series begun last month, under the title of "The Growth of the Cottage," and is named as above. To those who saw the first plan, and understand the scheme, the present number will need but little explanation, as the additions will readily be perceived; while to those who see the present illustration without knowing what has gone before, a brief recapitulation will be appreciated.

The design then of this series of three illustrations, the first of which appeared the November number, is to so plan a cottage that it might be subsequently enlarged twice, making the additions with an eye to a completed whole, so that nothing is built which need be demolished at the subsequent enlargement, and also so treating the additions that they do not appear to be the after-thoughts and patches that such operations usually present; but the house, after each enlargement, has a finished look, and could be left complete at its first or second stage—looking, and really being as well, for its situation, size and price, as any plan not designed for completion by stages.

The additional accommodations given here, over those provided in the first plan, are, increased cellar room, a front stairs, hall, vestibule, parlor, and side porch; a large chamber over parlor, with bath-room adjoining, placed between the two principal chambers, and accessible from them, and also the hall. This is a *beau ideal* situation for a bath-room, with the one exception of being rather far away from the kitchen, where the hot water to supply the bath must be generated. The consideration, however, of the private accessibility from the two chambers—the best rooms on the floor—and also equal ease of approach from the hall, point out this situation as the best, notwithstanding its remoteness from the kitchen. The front stairs can be continued to the attic, where one well-lighted room can be formed, and two sufficiently lighted storerooms.

It will particularly be noticed by those who have studied the first plan, and now see this one, that there has been no waste in throwing away parts of the first one which cannot be used in re-habilitating the house. The porch in the "Young Couple's Cottage" is only moved forward in this design. The twin window in the first plan is used again in the second, and its place is filled by sliding doors. The window in the hall of the first plan is made a door in the second, etc.

The cost of the addition is calculated to be about $1,000, which, though seemingly disproportionate to the cost of the nucleus—the "Young Couple's Cottage"—is not so really, when it is understood that the work interiorly is of a better grade—the front stairs, for instance, the back parlor cornice, mantel, sliding doors, the bath and fixtures necessary to it, the rooms in the attic, the side veranda, etc. The present plan could probably be executed for about $2,000, in plain style, and we are prepared to furnish working drawings of this house to parties desiring them, for $35. To parties desiring the extension plans—the additions to those procured last month—the cost will be $10.

Further information cheerfully given by the architect, F. T. Camp, 206 West 33d street, New York.

SPECIFICATION.

Excavate under whole house. Grade dirt around finished walls, or take off the premises, as may be directed. Lay base course 1 foot below cellar bottom, 6 inches on each side wider than net foundation wall, of large flat stone, laid across the trench. Net wall in center of base course, built to figured dimensions, of large rubble walling, laid to a line on both faces, in common brown mortar of the usual richness, pointed above grade with black mortar, made with Rosendale cement. Window sills of cut stone; also coping of chimneys, neatly chisel-cut. Foundation wall to extend under porch, making part preparation for subsequent additions contemplated in this series. Piers in cellar, also chimneys, of ordinary kiln hard-burned brick, laid in brown mortar, according to plans. Between joists over partitions to be filled with brick, to stop drafts and vermin.

Plaster.—Lath all side walls and ceilings in first and second stories with good sound lath, well nailed, and cover with one coat brown mortar well haired, one coat browning well floated and trued, and finish with coat of lime putty and calcined plaster, properly gauged, floated, trowelled, and polished. Run stucco cornices in the following rooms, and of these sizes: Parlor, 7½x13 inches; center, 2 feet 9 inches diameter. Dining-room cornice, 6x10 inches; center, 2 feet diameter. Hall cornice, 5x8 inches; center, 18 inches diameter. Vestibule cornice, 3x6 inches. All other cornices, 4x7½ inches.

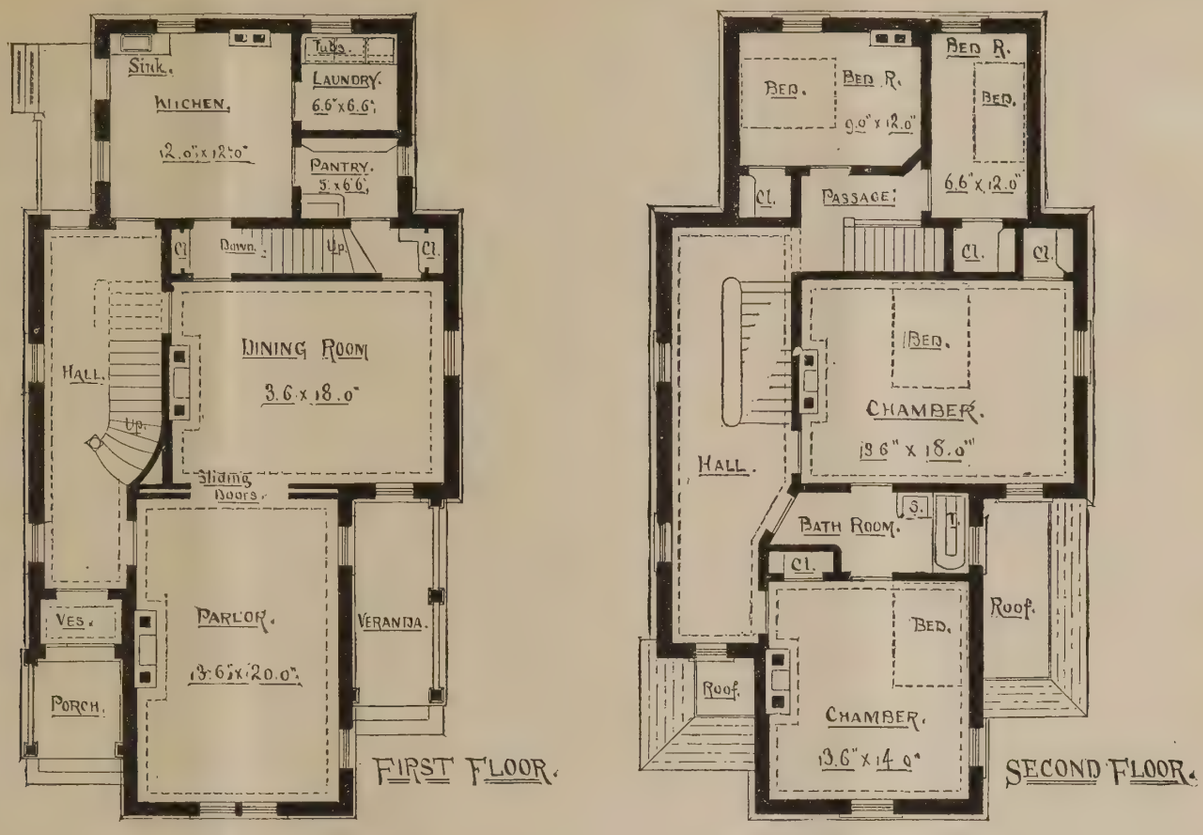
Carpenter-Work.—Sizes of timber as follows: Sills, doubled, 2x6 inches; studding, 2x4 inches; partition caps, doubled, 2x4 inches; braces, 2x4 inches; joists, 2x10 inches; bridging, 2x2 inches; rafters, 2x8 inches; ceiling beams, 2x6 inches—all of sound, square-edged spruce or hemlock, worked and erected in style known as "balloon" frame, thoroughly spiked and nailed. Roofs covered with gang-sawed hemlock boards, well nailed, also outside of vertical walls. Cover walls with building paper, and roofs with tarred paper. Clapboard walls with 5-inch bevel sawed pine clapboards, laid 4 inches to the weather, and slate roofs with unfading black or purple slate 10x20 inches.

Outside finish of a good quality of white pine, well seasoned. Corner boards and window and door frames of 1¼-inch; friezes, panel backs, beaded ceiling in panels, piazza posts, cresting, ornamental cut facia of cornice, etc., of ⅞-inch. Brackets built up. Water-table of 1½ inches. Cap got out of solid. Porch floor of yellow pine, over a rough hemlock floor, with tarred paper between, the yellow pine joints thickly white leaded. Porch roof covered with tin. Sash of 1½-inch white pine, well seasoned, ogee, check rail, number of lights shown on elevations, glazed with second-quality American sheet glass, bedded in soft fresh putty, hung with pulleys, weights and best hemp cord, and fastened with an approved sash lock.

Outside doors of pine, 2½ inches thick. Front doors as shown, with plate glass top panels, lower panels raised molded, center panel with raised center, alike on both sides. Vestibule door a wide single door, with three panels—top, middle and lower—the top and middle panels of embossed glass, and the lower panel raised, and all enclosed in raised moldings, both sides alike. Kitchen door, four-panelled, ogee inside, and raised molded outside. These doors hung with three butts each, trimmed with good locks and catches, also bolts of brass, flush on front door. Interior doors hung with two butts to a door, trimmed with mortise locks and catches, to be 1⅛ inches thick, and all doors to have white porcelain knobs, with silver-plated roses and escutcheons.

Floorings of 1¼-inch spruce plank, not over 6 inches wide, matched, tongued and grooved, and blind nailed. Stairs, front flight to extend to attic, open, and built with wall string, molded same as base in hall up to passage to rear part; then molded as for the rest of second story up to attic. A good newel, costing about $8; rail, 2½x4½ inches, toad-back, 2 inches square, and turned balusters, dovetailed to ends of steps; all of black walnut; to trim front flight. Risers, ⅞ inch and treads 1⅛ inches, molded, nosings housed in wall strings; all of clear white wine. Stairs open under on first floor. Rear stairs one close flight, steps housed in strings; risers, ⅞ inch; treads, 1⅛ inches; molded nosings; all of white pine; newel, 8 inches, of black walnut, square base, and turned shaft; rail plain toad-back, 2½x4 inches; balusters, 1⅛ inches square, turned shaft. Flight to cellar of rough stock; treads, 2 inches; risers, 1 inch; white pine, and common hand rail below floor.

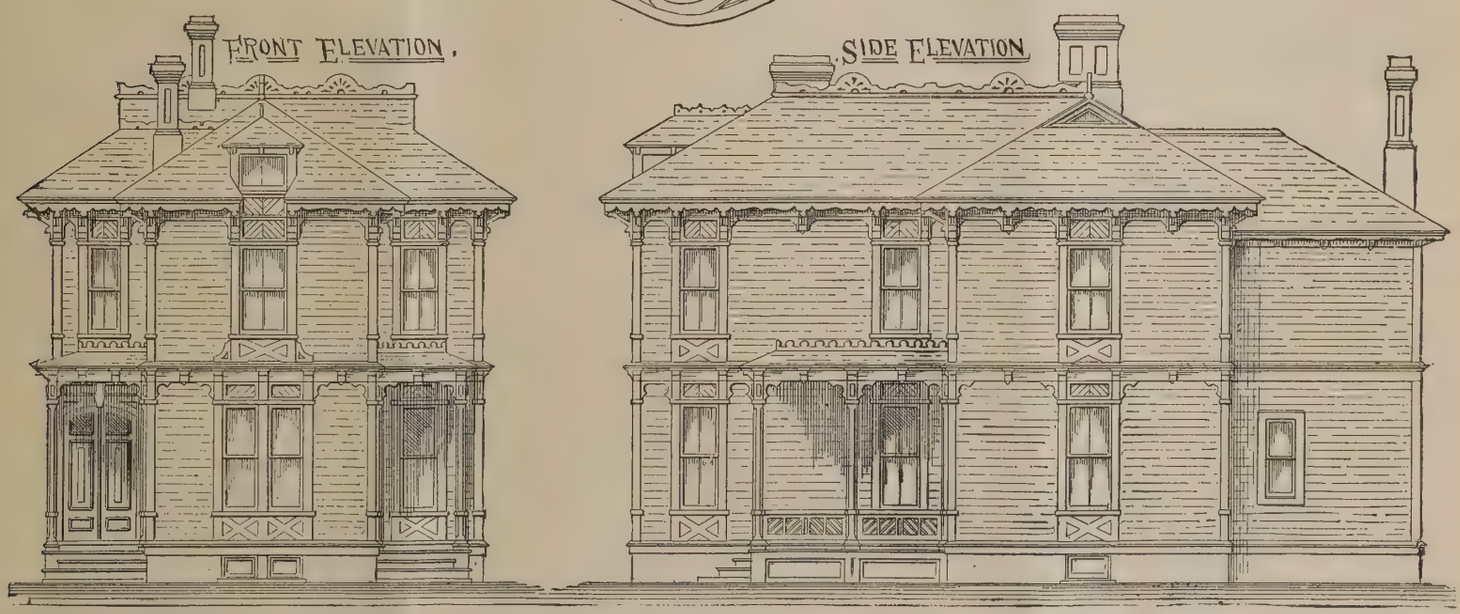
Inside Finish.—Architraves in hall, parlor, dining-room, and front rooms of second story, of pine, 5 inches wide, with a band mold 1x2 inches. In other rooms 5-inch plain bevelled. Bases in first-mentioned rooms 10 and 8 inches high; in first and second stories 9 inches high, including 2-inch molding. Plain bevelled bases in rest of rooms, closets, etc., all of a good quality clear white pine. Windows in principal rooms panelled under, and architraves brought to the floor.



Fred'k J. Camp
Architect.

THE FAMILY HOUSE

No 206 West 33d St.
New York City.



THE GROWTH OF THE COTTAGE. No. 2.—"The Family House."

Fittings.—Cupboards in stair passage to have glass doors above and drawers below, in the usual form; shelves behind glass doors. Other shelving in pantry and over sink in kitchen—open. Closets in second story to have three shelves where marked. All shelving on beaded cleats (screwed), of good pine. Tubs in laundry of 2-inch clear pine plank, dadoed, and joints painted with thick white lead. Sink shelf of 1½-inch pine. Sink of iron, and open underneath. Provide and set on stand a 40-gallon, heavy sheet-iron, riveted, galvanized boiler, stand in kitchen near chimney and ready to connect with water-back of portable range through ¾-inch triple A lead pipe, supplied from street or tank through 1-inch galvanized wrought-iron pipe. All supplies to water-closet, bath and wash tubs, and sink, to be ¾-inch galvanized wrought-iron pipe. Cocks of ⅝ lever, brass for sink and wash-trays and silver-plated for bath-room. Water-closet pull and cup silver-plated, and the closet to be of the Jennings style. Tub and seat cased in panelled black walnut; seat to have two brass hinged lids, and tub a surbase of wainscoting 12 inches high. Pipes run in warm, sheltered situations. Clothes hooks on cleats in all closets. Four marbleized slate mantels, where shown, of the average value of $30, both fitted for fire-places. Trap-door in ceiling of second story hall, to lead to attic.

Painting.—All exterior wood-work to receive a priming and two good and sufficient coats of boiled linseed oil and white lead paint, tinted a medium brown for cornices, friezes, corner boards, etc., and a light gray for all body work. Ceiling of porch sky blue. Yellow pine oiled two coats. Sash drawn dark brown. Brackets picked out in these colors. Chimneys also painted; base and bands brown, body gray. Inside work of two shades; all stiles, rails, moldings, etc., a blue-white, and panels and body-work cream tints, in priming and two coats. Black walnut oiled and shellacked twice.

Work and material to be thorough and of good quality.

Plans and specifications are intended to coöperate so that which is necessary to the completion of the building, according to their meaning and intent, shall be supplied and done, whether the same be specifically mentioned or drawn, or not.

Correspondence.

Metric Weights and Measures.

To the Editor of the Manufacturer and Builder:

It is very evident to all thinking minds that the day is not far distant when a demand will be made that our present system of weights and measures—absurd and cumbersome as the system is—shall give place to some system more simple and natural. Why our system of weights and measures was not reformed at the time of the adoption of our decimal system of Federal money, is a puzzle to many, and history records that an attempt was made about that time to simplify our system, but the whole matter failed, I apprehend, because it was impossible to convince the people then that the substitution of any system with an *imaginary* unit or basis would be any great improvement over the system or systems (or rather, want of system) then in use. Since that time, however, the metric system has come into existence, and the reason it has not been in operation in this part of the commercial world for scores of years past, is almost wholly due, no doubt, to the "jaw-breaking" terms coupled with the system. I do not speak for the educated, or those who are familiar with Latin terms and phrases, but for the commercial world. Let savants remember that probably not one in a thousand—yes, ten thousand of our trades people, understands Latin, and probably not one in the same number would to-day willingly exchange our present system, complex and cumbersome as they all will acknowledge it to be, for the simple and desirable metric system, if they were obliged to retain its Latin terms. In view of this fact, which I think is undisputable, why do not those in authority give us the admirable metric system clothed in English?

To show that this can be very readily done, I append a series of metric tables, and retain the terms now in use, as far as possible. By having the same number of terms above and the same number below, the unit in the new tables as are usually employed in the metric system proper, no confusion would arise from changing from our new system to the metric proper in all transactions we might wish to have with the foreign metric commercial world, as a glance at the proposed new tables will show.

WEIGHTS.

	Minim=	.01543 grains,	avoirdupois.
10 Minim,	1 Centim=	.1543 "	"
10 Centim,	1 Decim=	1.5432 "	"
10 Decim,	1 Grain=	15.432 "	"
10 Grains,	1 Ounce=	.3527 ounces,	"
10 Ounces,	1 Pound=	3.5274 "	"
10 Pounds,	1 Stone=	2.2046 pounds,	"
10 Stones,	1 Quintal=	22.046 "	"
10 Quintal,	1 Cental=	220.46 "	"
10 Cental,	1 Ton=	2204.6 "	"

Observations.—The unit (the Grain) is of the exact value of the metric *Gram*, and all of the terms above and below, of course, have values corresponding to metric terms occupying the same relative position. The new *Ounce* would be almost exactly $\frac{1}{8}$ of the value of the present ounce, the new *Pound* would be $^1/_5$ of the present pound, and the new *Ton* $1^1/_5$ the value of the present ton. These leading values in the present and the proposed system are so nearly a proper fractional part one of the other, that it would seem that little or no confusion need result in selling goods bought by the old system. By the new, the difficulty thus overcome being one very great objection to a change at all.

LONG MEASURE.

	1 Nail=	.0394 inches,	or $^4/_{10}$ inch nearly.
10 Nails,	1 Inch=	.394 "	" $\frac{1}{3}$ " "
10 Inches,	1 Foot=	3.937 "	" $\frac{1}{3}$ foot "
10 Feet,	1 Yard=	39.37 "	" $1^1/_{10}$ yard "
10 Yards,	1 Rod=	393.7 "	" 2 rods "
10 Rods,	1 Acre=	3937 "	" 20 " "
10 Acres,	1 Mile=	.6214 miles,	" $^3/_5$ miles "
10 Miles,	1 League=	6.214 "	" $6^1/_5$ " "

Observations.—It will be seen by the table that the new *Inch* would be very nearly $\frac{1}{3}$ of our present inch, the new *Foot* would be almost exactly 4 inches, the new *Yard* would be but $^1/_{10}$ longer than our present yard, the new *Rod* would lack less than 4 inches of being twice the length of our present rod, and the new *Mile* would be about $^3/_5$ of our present mile. The new term *Acre*, as signifying length, introduced for convenience in square measure, (see table following), would prove very convenient in practice, being almost exactly 20 of our present rods. The new *Yard*, printed in small capitals in the table, being the unit, and exactly equalling the Meter, the metric unit of long measure.

SQUARE MEASURE.

	Square Nail=	.00155	square inches.
10 Square Nails,	1 Inch=	.155 "	"
10 " Inches,	1 Foot=	.108 "	feet.
10 " Feet,	1 Yard=	10.763 "	"
10 " Yards,	1 Rod=	1076.361 "	"
10 " Rods,	1 Acre=	2.471 (or $2\frac{1}{2}$)	acres.
10 " Acres,	1 Mile=	247.1	"
10 " Miles,	1 League=	24710	"

Observations.—As will be seen, the new *Acre* would lack less than $^3/_{100}$ of being exactly $2\frac{1}{2}$ of our present acres. One great objection to the metric system has been that it would unsettle our land surveys and lead to no end of trouble in re-adjusting our titles to real estate. The proposed new American metric system, if you choose so to term it, now under consideration, most assuredly would not do this, for there is not one tract of land in ten thousand located by our public survey that would not be as accurately expressed by saying "64 metric acres," as by saying "160 acres," as at present. Not one 160-acre tract in ten thousand contains *exactly* 160 acres, so the new system would be practically just as accurate as the old.

CUBIC MEASURE.

	Cubic Nail=	.000061	cubic inch.
10 Cubic Nails,	1 Inch=	.061 "	"
10 " Inches,	1 Foot=	61.024 "	"
10 " Feet,	1 Yard=	1.3 ($1\frac{1}{3}$) "	yards.
10 " Yards,	1 Rod, etc.		

MEASURES OF CAPACITY.

	Drop=	1 minim,	liquid measure.
10 Drops,	1 Dram=	2.7 drams, "	"
		.0845 gills, "	"
10 Drams,	1 Pint=	$\frac{1}{8}$ pint, "	"
10 Pints,	1 Quart=	1 quart, "	"
10 Quarts,	1 Gallon=	$2\frac{3}{4}$ gallons, "	"
		9 quarts, dry	"
10 Gallons,	1 Barrel=	26.417, gallons, liq.	"
		$2\frac{3}{4}$ bushels, dry	"
10 Barrels,	1 Pipe=	264.17 gallons, liq.	"

Observations.—The dram equalling 2.7 (3) fluid drams, druggists would experience little difficulty in passing from the old to the new system The bushel could be retained as intermediate between the gallon and barrel—5 of the new gallons equalling but a trifle less than $1\frac{1}{3}$ bushels, and 3 a little less than a bushel. The new *Quart*—the unit in this table—equal to the metric *Liter*, is but about $^6/_{100}$ larger than the present quart, so merchants would experience no difficulty practically in passing from the present to the new system in handling fluids of all kinds.

PAPER AND BOOKS.

10 Sheets,	1 Bunch=	$\frac{1}{2}$ quire nearly.
10 Bunches,	1 Quire=	4 " "
10 Quires,	1 Ream=	$2^1/_{10}$ reams "
10 Reams,	1 Bundle=	21 " "

I do not consider that this matter has been exhausted by any means; but if I shall have induced others with superior fields for information to turn a passing thought to the subject, and prepare the American people for a change that is inevitable, my object in hastily preparing the foregoing will be accomplished.

American Metric.

OUR COMMENTS ON THE ABOVE.

We used to be, if not in favor of adopting common names for the metric system, at least not opposed to it; but after many years of deliberate consideration, we have come to the conclusion that if we adopt the metric system without the names, and substitute other common names for them, we will not derive the full advantages, and at the same time introduce objectionable features of a serious character. In regard to the assertion that the metric names are not only difficult to learn, but "jaw-breaking," let us remark that much more difficult and complicated words are almost daily introduced in the English language, which is a language essentially adapted to incorporate new words; it is in fact a double language, the short words being mostly of Saxon origin, and in this way related to the German and Dutch, while the longer words are in general derived from the languages of the Latin races, and in this way related to the French, the whole difference often consisting in a different twang of pronunciation and inversed accentuation.

The Dutch were the first nation in Europe to adopt the metric system, and had it in general use even before the French themselves; they gave the various measures the common names, and prefixed to them the designation, "New Netherland yard," "New Netherland acre," "New Netherland bushel," "New Netherland pound," etc., in order to distinguish them from the old abolished measures. This they now regret, for two reasons, first, by abolishing the metric names they destroyed the decimal connections of the names themselves, which is one of the beauties of the system. When we retain the names furlong, yard, foot, etc., children have to learn that a furlong is 10 yards, a yard 10 feet, etc.; but if we accept the word meter, with the prefixes deci, centi, and milli, which surely everybody understands, while children easily learn what they mean, the names decimeter, centimeter, millimeter, deciliter, centiliter, or decigram and centigram, explain themselves. The second cause of regret is the continual confusion which arises from using the same names for the old and for the metric measures, especially as people are inclined to abbreviate and leave off the designation "New Netherland" before the yard or pound. We make these detailed statements as it has been suggested by some to do the same thing here, and designate the metric measures in a similar way, and call the meter the new American yard, the kilogram the new American pound, the hectare the new American acre, etc. We hold that meter, kilogram, and hectare are the simplest, and certainly cannot be considered jaw-breaking for an English-speaking people, of which the language for foreigners is far more "jaw-breaking" than foreign languages can be for an educated American.

These are the reasons why we are opposed to abolishing the beautiful metric names, and wish them to be retained and adopted with the system; all that has to be done is to familiarize school-children with them by inserting them in their books on etymology, which certainly contain much more difficult names, and which they learn successfully.

But then it should be represented as the simple systematic system that it is; for instance, in this way: The units for measures of length, surface, (large and small), volume and weight, are respectively called *meter, are, stere, liter* and *gram*. The subdivisions are 10, 100 and 1,000, and respectively designated by the Latin prefixes *deci, centi* and *milli*. The multiples are by 10, 100, 1,000 and 10,000 times, and respectively designated by the prefixes *deca, hecta, kilo* and *myria*.

This is all that has to be learned—twelve short words, consisting of five roots for the units and seven prefixes; the rest will naturally follow, and the beauty is that when the meaning of each of these twelve words is once understood, the 5×7 or 35 names which result from their combination, explain themselves, as then it is no longer necessary to explain that a deciliter or decigram is 10 centiliters or 10 centigrams.

We call attention to a most comprehensive scheme of the metric measures, which is to be found in the latest edition of Webster's Unabridged Dictionary; it is by all odds the best we have met. It should be inserted in every school arithmetic, and teachers should overcome the prejudices which we find

among many of them, and which simply are the result of an imperfect acquaintance and consequent defective appreciation of the superior merits of the metric system.

HEATING BY HOT AIR.

To the Editor of the Manufacturer and Builder:

I saw in the *American Gas-Light Journal*, of October 2, 1879, an extract from the Manufacturer and Builder on "Steam Heating as Applied to Cities." The closing part of the article in the *American Gas-Light Journal* is as follows: "But the true inwardness of the criticism of 'An Engineer' crops out in his closing paragraph. He says: 'What we need is a cheap, clean and convenient fuel for all purposes in the shape of gas —fixed, unchangeable and non-explosive, and capable of producing any degree of heat, from the boiling of water to the smelting of iron.'"

This so fully calls for what I have secured by letters-patent, that I am induced to write you. I remark first, that Mr. Munn, of the *Scientific American*, said my design was to carry a reservoir of hot air to every man's residence and place of business. This answers "An Engineer's" description of what is needed. It is cheap; 16 or 16$\frac{1}{6}$ tons of coal per day of 24 hours, on an average, will supply New York city with all the heat it requires for warming buildings, cooking, and giving a hot blast for smith fires. What is cleaner than the air brought from a healthy locality, within or without the city, to any reasonable distance, for, according to Mr. Haswell, with an experiment we made in the loss of heat, we can carry the hot air 450 miles in every direction from the fire in the main pipe, with a degree of heat for any kind of cooking. What can be more convenient? We convey the hot air and receive it the same as gas. It is fixed, unchangeable and non-explosive, and capable of producing any degree of heat, except smelting metals, as to which I have no means of ascertaining.

I will give the annual saving by this method of furnishing heat, compared with the present mode:

	Annual Saving.
New York City	$4,232,640
Philadelphia	3,244,640
Brooklyn	1,616,640
St. Louis	3,033,280
Chicago	2,935,280
Boston	1,344,320
Cincinnati	1,683,200
Buffalo	779,750
Newark	476,640
New Haven	182,480
Hartford	162,480
Springfield	140,675

These are the annual savings, according to the best information I have been able to obtain. My impression is that it will come short of the full amount (over 90 per cent) saved by using compressed heated air carried and received the same as gas. There are 95 cities in the United States, containing from 20,000 up to 1,064,000 inhabitants, including the above cities.

As Mr. Holly has adopted my plan of furnishing heat to a city from one locality, so far as he can by the use of steam, perhaps it would not be out of place to give a comparison of the two methods—he using steam, I compressed heated air. Both methods depend on the amount of pressure and the degree of heat carried in the pipes, and the cost. To carry the same amount of pressure and the same degree of heat in the pipes by steam in the same time that we carry compressed heated air, will require 6,134 tons of coal by steam, to 8 tons by heated air. William Bliss.

Ashleyville, Mass., November 25, 1879.

Answer to the Above.—Our correspondent does not appear to realize the peculiar advantages of the use of steam consisting in the fact that by its condensation to water, every pound gives off 962 units of heat. Hot air is about the worst material imaginable to transmit heat. Its capacity for heat is about 3,200 less than that of water—that means, that one cubic foot of water can absorb, and give off again, as much heat as 3,200 cubic feet of air; so water has an immense advantage in regard to the bulk of the pipes in which it is to be transmitted, as a 1-inch pipe with hot water can carry as much heat as a 2-foot pipe filled with hot air. But then you may object that you cannot heat water as hot as air. You can; it then becomes steam, and the steam you can heat as much as air; but herein by no means lies the advantage. If the steam carried only the sensible heat it possesses, it would be no better than air; but its great and enormous advantage is that at the place where it condenses, it gives off its latent heat—that is, the heat which does not show in the thermometer, but which the water absorbs and causes to disappear when it changes into steam. To make this clear, let us say that you have 1 pound of water at the freezing point; you heat it 180°, and steam commences to form, but at the temperature of 212° it will not flash into steam at once by any means, but will continue to absorb heat, and if we measure the heat by comparison, it will be found that as much heat is in this way absorbed and carried off by the steam as would be sufficient to heat 5½ pounds of water from the freezing to the boiling point.

So you see that for every pound of steam passed through tubes, an amount of heat is transmitted sufficient to heat 5½ pounds of water from the freezing to the boiling point. But the most beautiful peculiarity of such transmission of heat by steam, is that this heat does not appear as long as the steam remains steam, and if the pipes are well protected the steam of 212° to 240° can be carried great distances; but where it is passed through pipes or boxes exposed to the cold air, it will condense in them and give off all this latent heat—an amount which, as we have explained, is for every pound of steam capable of heating 5½ pounds of water from the freezing to the boiling point, and 3,200 times this bulk of air. This is the reason why steam radiators have become such favorite means of heating buildings; steam is 5½ times better than water, and water 3,200 times better than air, consequently it is 18,000 times better than air—that means, that a steam pipe can carry as much heat as an air pipe of 18,000 times the capacity.

It appears from this that the large sums estimated by our correspondent to result as saving in consequence of the introduction of his method, are chimerical, as the whole system is based on error from beginning to end.

We recommend some of our chapters on the "Theory of Steam Engineering" to our correspondent for perusal, especially Chapter X., on the latent heat of vapors, to be found on page 2 of our January number for 1875.

EXPLANATION OF THE GYROSCOPE.

To the Editor of the Manufacturer and Builder:

Will you please continue your history of your experiments with the gyroscope as begun in the Manufacturer and Builder in 1877. Many of your readers are eager for the explanations of the different forms of gyroscopes and their respective experiments. It is believed that you submitted a very exhaustive and lucid paper on the subject to the Mechanics Institute of New York city some years ago. Would it be asking too much of you to publish that paper in your columns?

Respectfully, G. M. D.

Defiance, Ohio, November 28, 1879.

Answer to the Above.—The paper referred to is rather too extensive for our columns. Part of it was published in our May, June and July numbers for 1877, to which we refer you. At some future time we may return to the subject in case public attention is again attracted to the instrument, which appears to be the case periodically.

Notes and Queries.

This department is intended to furnish, for the benefit of all our readers, information on any subject of scientific or practical knowledge falling within the field of The Manufacturer and Builder. *All persons possessing additional or more correct information than that which we give relating to the questions, are cordially invited to communicate it to us for publication. We also request that all questions or answers be written on separate pieces of paper, and addressed to the Editor.*

QUESTIONS.

(2530) Pressure of Steam on Cylinder Head.—I asked the *Scientific American* for information in regard to the steam engine when at work, namely, if steam exerts the same force on the cylinder head as on the piston, hoping to obtain some information. All the answer I get is, "Yes." I come to you to ask, Why? and if so, is not this one of the causes of the great loss of power in the steam engine, as scientists say that no more than one-eighth is obtained which the fuel should really give? How would it do to utilize this pressure on the cylinder head? How could it best be done?—W. F. A., * * *

(2531) Bronze Varnish.—Will you be kind enough to give a recipe for a size that I can mix with bronze powders, so as to use it as a paint for re-bronzing old gas fixtures.—W. M. W., Toledo, Ohio.

(2532) Preserving the Color of Dried Plants.—Can you inform me how I can prevent the leaves of plants I collect for my herbarium, from discoloring so much?—G. L., Pottersville, N. Y.

(2533) Ten-Penny Nails.—Why are small nails called 1 and 2-penny nails, and the large ones 10-penny, etc.?—T. F., Pellsville, Ill.

(2534) Making Cellars Water-Tight.—What kind of hydraulic mortar is the best to make a cellar water-tight?—D. S., Lebanon, Ind.

(2535) Plaster on Brick Walls.—I am about to plaster a small brick building, and do not intend to use lath, but propose to put the mortar on the bricks. I wish to know whether the bricks require to be prepared in any way, or kept wet while applying the plaster. An answer will much oblige.—W. K. B., New York City.

(2536) Restoring the Black Color of Cloth.—Will you please inform me how I can dye, or otherwise restore the color to black chinchilla cloth, without dipping or boiling it, either by application with a brush, cloth, or sponge?—T. E. H., Brooklyn, N. Y.

(2537) Toothache Remedy.—What application would you recommend for the cure of toothache, from which I suffer very much?—A Lady Reader, Mayville, N. Y.

(2538) Sanitas, a New Disinfectant.—What is the newly invented disinfectant, called Sanitas, made of?—T. M., Hampden, Me.

(2539) Palmelin.—What is the new red dyestuff that is so much like blood? What is it made of? Is it good for anything?—A Dyer, Paterson, N. J.

(2540) Pipes for Salt Water.—As lead pipes will not do for conducting salt water, I wish to ask what you would recommend. I want strong pipes, as the water is under considerable pressure.—R. D., Quebec, Canada.

(2541) Kerosene Oil vs. Gas.—I know that kerosene oil is much cheaper than gas. Have you tried, or heard from those who have used both, what the difference is, and how much cheaper? If you can give an exact and reliable statement of the difference, you will oblige several readers who have made a bet in regard to it, and agreed to let your decision settle the matter.—L. D., Rochester, N. Y.

(2542) Keeping the Mouth Shut.—Is it true that it is more wholesome to breathe through the nose than through the mouth, as I was lately told? I do not see what the difference can be. If I am wrong, please inform me why.—G. G., Delavan, Wis.

(2543) Steam Power of the World.—Has an estimate ever been made of the total steam power now in use in the whole world? If so, please give it. I do not mean the number of machines, but the horse-power or man-power they represent.—A. F., Niagara Falls, N. Y.

(2544) General Antidotes.—What is the best thing to be done in case a person becomes sick, and there is doubt as to whether it is the result of poison? As I am convinced that no time is to be lost, it would be very useful for general information to state what measures to take in cases where the attendance of a physician cannot at once be secured.—T. J., Noank, Conn.

(2545) Soluble Indigo.—How can I dissolve indigo? I tried to rub it up, but it sinks to the bottom as sand.—M. A., Tiltonsville, Ohio.

(2546) Telegraph Statistics.—Can you give me some data in regard to the number of telegraph offices, length of lines, etc.—T. F., Belmont, Me.

(2547) The First Patent Laws.—Where were the first patent laws enacted? When was a United States patent law first introduced?—T. K., Englewood, N. J.

(2548) The Pie-Eating Excitement.—Please give your opinion on the great pie-eating question with which the papers have lately been filled, in consequence of persons having been poisoned by them.—J. B., New York City.

(2549) Liquid Glue.—How can I make a good liquid mucilage that will stick well, and can also be used as glue? The mucilage I buy is only good for paper, and even labels come off, especially when pasted on tin cans or varnished wood.—D. S., Donaldson, Pa.

REPLIES.

(2530) Pressure of Steam on Cylinder Head.—The question why steam presses on the cylinder head surprises us. You might as well ask why the steam presses on the sides of the boiler, or on the safety valve. Of course the steam presses everywhere, not only on the cylinder head, but also on the sides of the cylinder, with an equal pressure of as much per square inch as the gauge indicates. The question whether this does not involve loss of power, is equally unnecessary. There is no loss involved in its pressure on the boiler, or on the pipes, or on the sides of the cylinder, because they cannot move, and therefore do not cede to the pressure, and consume no steam; but any surface that is pressed backward by the steam, by which motion steam is consumed, causes a consumption of its power. Pressure without motion is not power, and the object pressed does not consume power, as long as it does not move. Thus you see this is not the reason why we do not obtain the full mechanical equivalent of the fuel. Attempts have often been made by parties, who did not understand this, to utilize the pressure on the piston head, by means of two pistons, letting the steam enter between them; but of course with no beneficial results whatsoever, except that a small balanced engine was the result, in which the momentum of one piston was balanced by the motion of the other in an opposite direction, so that it could be run at a very high speed without being shaken. The pressure of the steam on the cylinder head is best illustrated in a locomotive, in which this pressure on the cylinder head drives it forward every time the piston moves backward; when the piston moves forward the piston rod and connecting rod act on a lever, in which the point of contact of the wheel with the rail is the fulcrum, while the axle of the wheel is the resistance. When the piston strikes backward, the pressure on the cylinder head pulls the axle of the wheel forward. Here then is the power applied, while the piston becomes the resistance. This back pressure on the cylinder head used to be one of the arguments in favor of rotary steam engines, but experience has proved that they are about the most wasteful of all, and theory has now fully explained why this is so.

(2531) Bronze Varnish.—Any transparent varnish will do; say amber, gum damar, or copal varnish. Mix the bronze powder with it, but do not mix more than you are going to use at once, because most bronze powders act as powerful dryers, and what you have left of the mixture soon becomes hard and useless. It is best to put a little of the varnish in a small flat saucer, and some of the loose powder next to it, and mix with the brush while you are using it, as a painter mixes colors on his palette.

(2532) Preserving the Color of Dried Plants.—We find in a reliable German journal of practical science, the following recipe, which we have not tried, however. Dissolve 1 part of salicylic acid in 600 parts of alcohol, heat the solution to boiling in an evaporating dish, and draw the whole plant slowly through it—prolonged exposure discolors violet flowers; shake

off any excess of liquid, dry between blotting paper, and press in the usual manner. A frequent renewal of dry blotting pads, particularly at first, is desirable. Thus treated, plants are said to dry rapidly, furnishing beautiful specimens which retain their natural colors in greater perfection than by any other process.

(2533) Ten-Penny Nails.—The word "penny" as used here is a corruption of the word "pound." Nails should be called 1-pound, 2-pound nails, etc., meaning that 1,000 nails of that size weigh 1 or 2 pounds; 10-penny nails, that they weigh 10 pounds per 1,000.

(2534) Making Cellars Water-Tight.—There is no mortar that is water-tight. Hydraulic mortar only hardens in water, but is porous. To make your cellar water-tight, you must dip the bricks intended for the floor and side walls into melted asphaltum, and use this also as a cement.

(2535) Plaster on Brick Walls.—If your wall is a single brick wall, exposed to the weather, and the bricks are the least porous, you will have cause for regret should you apply the plaster in the manner you propose, because the moisture from rain-showers on the outside will penetrate to the plaster, and there is constant danger that it will come off in patches, especially when the wall is exposed to the east. In order to put mortar against an outside wall, it must be a double brick wall, or at least one and a half brick thick, the bricks hard baked, not porous, and laid in good cement. Of course the bricks must be wetted, as mortar will not adhere to dry bricks at all. The success of your plan depends also a great deal upon the situation of the building; if exposed to the wind, so that rain-storms strike it forcibly, there is much more danger of the mortar inside coming off than if it stands protected against strong blasts. In the latter case we would not hesitate so much as in the former, in which we would prefer lath.

(2536) Restoring the Black Color of Cloth.—It is a very common and easy practice to restore faded black colors by simply brushing them over in succession, first with a solution of logwood extract, and then a weak solution of bichromate of potash. Another way is to take first a decoction of crushed gall-nuts, and then a solution of sulphate of iron. In either case the black color is easily restored by a brush or sponge. We prefer a stiff brush.

(2537) Toothache Remedy.—If the pain is caused by a cavity in the tooth, you can easily apply something that will relieve you; but you must first clean out the cavity from food or other matter which may have accumulated in it. To kill the pain dentists use a mixture of morphine, creosote and arsenic. This at the same time kills the nerve, and prepares the cavity for filling; it arrests further decay, which goes on very rapidly when not attended to in time. If well filled, the tooth will last as long as any sound tooth. There are various home remedies which can be recommended to put into cavities to relieve pain; these are, oil of cloves, carbolic acid, creosote etc., but one of the best appears to be tincture of benzoin; it has lately been recommended by Dr. T. C. Osborn, who states his experience with this remedy, which he found the best of all, and now uses it exclusively. *Note.*—After writing the above, we find that the toothache drops sold by some druggists as an unfailing remedy, which indeed it appears to be in reality, are nothing but this very same tincture.

(2538) Sanitas, a New Disinfectant.—When turpentine over water is exposed to sunlight, a slow decomposition takes place, and ozone and hydrogen peroxid are formed, both powerful bleaching agents; hence attempts have been made to bleach in this way. Sanitas is made in a similar way, but by more effective means than simple exposure. It is found best to use Russian turpentine, putting it with water in large earthen jars, warming it to 90° Fah., and blowing a blast of air through it; this mingles the water, turpentine and air thoroughly. The result is a decomposition of the turpentine, evolution of ozone, and a precipitate, which contains principally camphoric acid and hydrogen peroxid. The material which is left floating on the water is mixed with lime, making a dry powder, and is sold as a disinfectant, as well as the precipitate. Sometimes they are mixed, but the floating material is considered the most valuable as a disinfectant.

(2539) Palmelin.—You refer, no doubt, to the color obtained from a plant growing on damp stones, called Palmella Cruenta, from which the color has been named Palmelin. The plant belongs to the *Algæ* family, and, very often growing like a film, has sometimes been mistaken for blood spots, as in a recent murder case in Connecticut, where a physician, making an examination of the surroundings of the victim, thought he found human blood on a stone, which the microscope afterward revealed to him to be a plant. (We refer to the case of Rev. Mr. Hayden, accused of the murder of a young girl). In order to obtain the color from this plant, it is dried in the air, drawn with a small quantity of water for 24 hours, when the color will dissolve, and, after filtration, shows a fine rose colored liquid—orange-yellow by reflected light. The coloring matter of this solution has actually a close resemblance to that of blood. Both are insoluble in alcohol, ether, benzin or carbon bisulphid, but are very soluble in water; both contain iron, and undergo putrefaction by a gentle heat; both coagulate by greater heat, or when acetic acid or alcohol is added to a watery solution. Even the absorption bands, as seen by the spectroscope, are similar, but not entirely the same, so that the spectroscope can distinguish between the two. Whether this substance will become a valuable dyer, and that it can be produced in sufficient quantities, are questions which only experience can decide.

(2540) Pipes for Salt Water.—Perhaps the cheapest would be wooden tubing; enamelled iron would be better, but the best of all are glass-lined iron pipes, recently introduced in some New York residences. However, if you want a large stream, of say 6 inches, the enamelled iron would be best, as the glass-lined pipes are only adapted for diameters of from 1 to 2 inches, therefore most excellent for domestic use, where thicker pipes are not needed.

(2541) Kerosene Oil vs. Gas.—Our own experience has shown us that gas costs at least from four to five times as much as kerosene. But we have made inquiries of dining-saloon keepers and others who had used gas, and for the sake of economy during 1878, substituted kerosene for gas, and their statements agree pretty well. One said that his gas bill was $20 per month on the average, and he now lights his rooms for $4 worth of kerosene per month, and claims to have twice as much light. Another had a gas bill of $25 on the average, and now uses about $4 worth of kerosene. Now for theory: One cubic foot of kerosene is, in illuminating power, more than equivalent to 5,000 feet of illuminating gas; but one cubic foot of the best kerosene is 8 gallons, which, at 30 cents per gallon, retail price, amounts to $2.40, while 5,000 cubic feet of gas, at $2.50 per 1,000 cubic feet, cost $12.50; therefore gas must cost at least five times as much as kerosene, even with more light from the latter; and for equal illumination the difference is still greater.

(2542) Keeping the Mouth Shut.—We treated this matter in full on page 70 of our March number for 1871, to which we refer you. In addition to the reasons mentioned there in favor of breathing through the nose as much as possible, we will add that the influence of nasal respiration on the ear is illustrated by Mr. George Catlin in his "History of the North American Indians." Among 2,000,000 Indians he did not find one who was deaf or breathed through the mouth, except three or four deaf mutes; and within the memory of the chiefs of 150 tribes, not one case of deafness could be remembered to have occurred. This is explained by the mother always closing the mouth of the child whenever it attempted to breathe through it.

(2543) Steam Power of the World.—Such an estimate has been made with accuracy, as statistics of factories, steamboats and railroads are kept in all countries where steam engines are employed. The result is as follows: The aggregate steam power is at present 3,500,000 horse power employed in stationary engines, and 10,000,000 horse power in locomotive engines. This force is maintained without the consumption of animal food, except by the miners who dig the coal, and the force maintained in their muscles is to the force generated by the product of their labor, about 1 to 1,080. This steam power is equal to the working force of 25,000,000 horses, and one horse consumes three times as much food as one man. The steam power, therefore, is equal to the saving of 75,000,000 human beings.

(2544) General Antidotes.—The best remedy, no matter what the poison may be, is to take a teaspoonful of mustard and a teaspoonful of common salt, mix them with a teacupful of water, warm or cold, and let the patient drink it down at once. It will immediately cause vomiting, and all that there is in the stomach will be ejected. As soon as the stomach is quiet, give the patient the white of a raw egg, to neutralize what may have passed further down than the stomach; after that give strong coffee by the teaspoonful. Both the white of an egg and coffee are antidotes for many poisons. When a person has overloaded the stomach by eating indigestible food, or food not suited to his stomach, or, having a good stomach, has overloaded it with excessive eating or drinking, and feels very ill in consequence, the salt and mustard will also give immediate relief by causing the superfluous material to be thrown out.

(2545) Soluble Indigo.—There are various ways of dissolving indigo. Dyers dissolve it in an alkali, which makes it green; then when the material dyed in this solution is exposed to the air, the green color gradually changes to blue, while the alkali is neutralized. Another solvent is strong sulphuric acid; this makes an intensely dark blue solution. In order to get rid of the acid, it is diluted with water, and pulverized chalk (carbonate of lime) gradually added until all effervescence ceases, which is a sign that all the sulphuric acid has been neutralized. The sulphate of lime formed settles at the bottom with the superfluous chalk, and the liquid over it clarifies gradually to an indigo blue, which is the soluble indigo used for laundry purposes, and also as ink; however, as it is not a bright blue, it is generally used to improve the brownish color of some other inks, so as to obtain a jet black or bluish ink, as the brownish inks do not find favor with the public.

(2546) Telegraph Statistics.—On this continent we have now, in round numbers, 10,000 telegraph stations, working 150,000 miles of wire, and transmitting 30,000,000 telegrams per year. In Europe there are 20,000 government telegraph stations and 15,000 special and railway stations, working 300,000 miles of wire, transmitting 100,000,000 paid and 25,000,000 international dispatches, by the aid of 50,000 telegraph instruments and 70,000 employees. In France the business seems to be the most systematically developed; 61 chief towns of departments are in direct telegraphic communication with Paris; the other towns communicate through intermediate offices. In Paris concentrate 113 direct wires from provincial centers, of which the principal ones have three or four wires, in order to transact the business; from Versailles to Paris there are 40 wires, while there are 23 long subterranean lines in France. There also concentrate in Paris direct wires from foreign centers, such as Amsterdam, Antwerp, Basle, Bern, Berlin, Brussels, Cologne, Florence, Geneva, London, Hamburg, Milan, Rome, Turin, Vienna, etc.; also a submarine wire from Marseilles to London, so as to be independent from disturbance of land wires. Asia has 500 stations, with 30,000 miles of wire, transmitting 3,000,000 telegrams; Africa, 200 stations, with 10,000 miles of wire, transmitting 2,000,000 telegrams; and Australia, 800 stations, with 30,000 miles of wire, sending 3,000,000 telegrams.

(2547) The First Patent Laws.—The first patent law originated in a statute of James I., in 1625, called a Statute of Monopolies, because it abolished all patents claimed for monopolies and substituted patents for new inventions only, while it held out in advance a prospect of reward in order to induce inventions. Our first Congress passed a patent law in 1790.

(2548) The Pie-Eating Excitement.—We have always been opposed to pie-eating in general, and to its abuse in eating too often and too much of it in particular. We agree perfectly with the opinion of Dr. Hammond, that nine-tenths of all the pies eaten are vile, mysterious and indigestible. *Pie is vile*, because the most dirty habits of the baker do not interfere with its preparation. An instance of this were the late serious cases of poisoning by pie prepared in copper vessels which were so dirty, and the verdigris got into the pies in such quantities that a scorce of people were sickened by it, and one man actually died from it. *Pie is mysterious*, because nobody who eats pie knows what is in it, nor can he possibly tell, except when he is poisoned by it; then it shows itself. As a rule, *pie is indigestible*, because most always the under crust is a soft dough, like putty, and lies very heavy on the stomach. Pie bakers should first bake the under crust alone before putting the filling in or paste on it; but, according to the general custom, it is put on before baking, and becomes so soaked that it cannot become sufficiently done, like the upper crust, which is the only digestible part of most pies. We are satisfied that many cases of dyspepsia would be relieved if the sufferers would only give up eating pie, and instead of taking for lunch a piece of pie would eat a piece of cold roast beef or beefsteak, which are about the easiest digestible articles of food in existence, the general erroneous opinions to the contrary notwithstanding, and are at the same time nourishing, which cannot be said of pie. In regard to the poison that got into the pies, we must say that the use of copper vessels for preparing any article of food should be forbidden by law. There is plenty of other material which can stand as much, and more, heat than copper, which has two grave defects—it is easily oxidized, and its compounds are very poisonous. Several years ago we had a case of poisoning in our own family, by a decoction which a druggist had made in a copper vessel. Candies are very commonly prepared in copper vessels, and the vessels in the course of time are worn out interiorly. All this copper worn off by use enters the candies, and it is eaten; but then, fortunately, sugar is one of the antidotes for copper poisoning, so that if you eat these candies you eat at the same time plenty of the antidote, and it will do no harm; but a pie, especially a lemon pie, does not contain enough sugar to counteract the copper, by which more is dissolved by the action of the acid in the lemons. Our advice is to leave pie alone, and eat plain meat and bread; there are varieties enough of them, especially of meat, and even with bread you may vary from day to day. The German habit deserves imitation in this respect; they by no means confine themselves to white bread, but also eat rye bread of more than one kind, coarse and fine, and above all Pumpernickel, which is claimed to be a cure for dyspepsia, if the case has not gone so far as to be unable to stand it. Then there is Graham bread, Boston brown bread, home-made bread, French bread, Vienna bread, etc. Then making dry toast, buttered toast, and milk toast of all these kinds of bread, you may vary your diet sufficiently not to need any indigestible compounds, such as are prepared and sold under the name of pies, of which the good ones are too rare to take the risk of eating any of them.

(2549) Liquid Glue.—You cannot use mucilage as glue, because it is not glue and does not possess the sticking qualities of good glue. It is made of starch, dextrin, or gum arabic, with some acetic acid, or other equally preservative substance in it to make it keep. If good, it will stick on glass; but to make labels stick on tin cans or on metal, you must mix a few drops of nitric acid with the mucilage just before you are about to use it, otherwise it will come off; this acid acts on the metal and destroys the polish, which prevents the sticking. It is the same with varnished objects; in order to make labels stick where they have a tendency to come off, mix a little alcohol with the mucilage. This partially dissolves some of the varnish, takes the gloss away under the label, and causes adhesion. Or you can rub the varnish with a little alcohol at the place where the label is to be put on; or you may stick the label on with varnish instead of mucilage. Some kinds of varnishes are good for this purpose; others not. In order to make a better sticking mucilage, you must not use starch or gum at all, but the best quality of glue. Soak it over night in plenty of water, in the morning pour the excess of water off, and put on a gentle fire, so as to melt the glue in the water it has absorbed during the night; then thin it with strong vinegar, or with acetic acid when you want it thick, and you will have a mucilage with which you can glue wood together, but you must not expect that it will be as strong as if you used hot glue, as cabinetmakers always do.